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Cover: Hydro-electric Plant in Fall Creek Gorge
Frontis: Fractionation Columns for Butadiene Production

—Courtesy Standard Oil Co.

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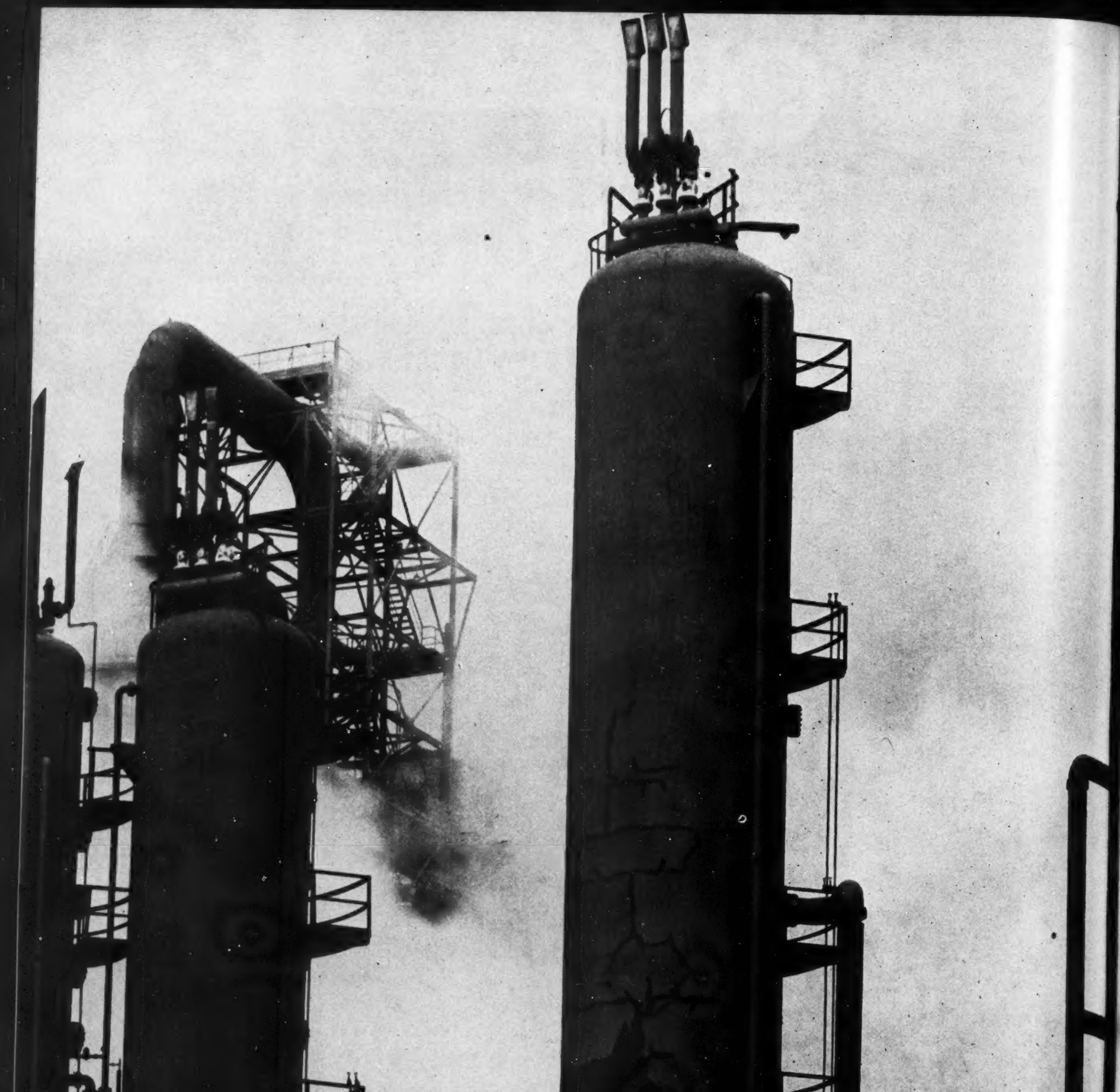

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CHEMICAL ENGINEERING IN THE FUTURE

By PROFESSOR F. H. RHODES

Director of the School of Chemical Engineering

THE end of the war will certainly be followed by a period of greatly increased industrial activity in the United States. There will be an enormous demand for material for rebuilding the devastated areas and for replacing the deficiencies of both consumable goods and construction in the countries that have not suffered direct war damage. This industrial upswing may not develop fully and immediately upon the cessation of hostilities. There may be a period of confusion because of the lack of a really adequate financial plan, and some delay in re-tooling and in making the necessary re-adjustments in labor distribution; but these will be only temporary.

This general acceleration of manufacture will be reflected directly by generally increased activities in the chemical engineering industries. The only major chemical industries that will probably not share in this general improvement are the explosives and direct munitions and the light metals and alloys industries. This war has seen an enormous increase in the productive capacity for aluminum and magnesium. There is no doubt that some new peace-time uses for these light metals will be developed; but it is doubtful that these could absorb the present output.

One of the important chemical industries that will show some very interesting post-war developments is petroleum refining. During the war there have been developed some greatly improved methods for cracking petroleum and for refining petroleum products. Furthermore, the demand for aviation fuel, toluene, butadiene, and other products has led to the construction of many large plants embodying the most recent developments, with the result that the improved knowledge has been very rapidly translated into improved operation. The post-war motor fuel will probably be of somewhat higher octane rating than that in general use before the war. Improvement in octane rating and in efficiency of power development from motor fuel may be expected, as fast as the introduction of modified motors to take advantage of the better fuel becomes general. We may also see a more general adoption of Diesel or modified Diesel engines for heavy-duty work.

Petroleum Products

Before the war the major products from petroleum were motor fuel, kerosene, fuel oil, lubricants, and asphalt. These will probably continue to be of primary importance, but we shall probably see an increased production of chemical products from crude oil. We are today manufacturing benzene, toluene, butadiene, glycerine, certain alcohols, and certain chlorinated hydrocarbons from petroleum; in the post-war years this list may be greatly extended.

Plastics Industry

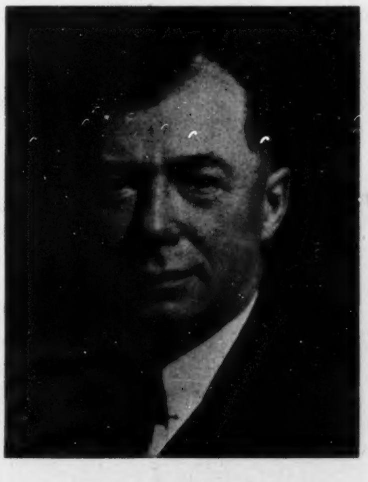
The plastics industry has recently attracted much popular interest. We may expect an increased use of plastics, although perhaps not to the revolutionary extent indicated by some of the newspaper articles. Plastic-bonded plywood has won an accepted place as a new and important material of construction, and plastics are widely used for waterproofing fabrics. Among the very interesting developments in this field is the production of compressed plastic-impregnated wood, which is so nearly waterproof and so strong and hard that it may be substituted for metal for some purposes. There is a real need for a very cheap plastic binder that can be used in the production of "artificial lumber" from low-grade wood or from wood waste.

THE AUTHOR

Professor F. H. Rhodes, although a graduate of Wabash College, has spent the major portion of his academic and teaching career at Cornell, obtaining his Ph.D. here in chemistry in 1914. In 1920 he returned to the campus as professor of industrial chemistry until 1933 when he became professor of chemical engineering.

In 1938 Professor Rhodes was appointed Director of the School of Chemical Engineering and in 1942 was awarded the Johnson Professorship of Industrial Chemistry.

The author of numerous chemical patents, technical articles and books, he holds membership in many honorary societies including Tau Beta Pi, Sigma Xi, Phi Kappa Phi, and Phi Beta Kappa.



Professor Rhodes

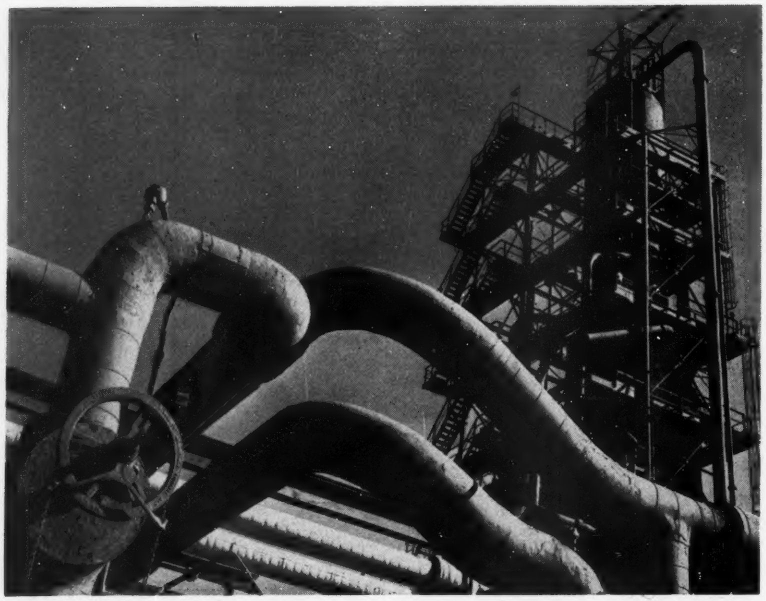


Photo by Rosskam —*Courtesy Standard Oil Co.*
Fractionation tower of a modern oil refining still. This still uses only an atmospheric fractionation tower, eliminating the vacuum tower.

One of the chemical engineering enigmas is the future of the synthetic rubber industry. We now have sufficient productive capacity for synthetic rubber to meet the normal peacetime demand for rubber before the war. The synthetic rubber made today may not be fully equal to natural rubber in every respect and for every purpose; there is good reason to expect that modification in type and improvement in production methods will lead to very great improvement in quality. On the other hand, in some respects and for some purposes, many of the synthetic rubbers now made are superior to natural rubber.

Synthetic Rubber

The synthetic rubber industry will survive to a limited extent, if only for the production of special types of rubber for industrial use. Also, as a source of rubber for tires it may have to encounter severe competition from natural rubber and face economic and political juggling. If the eastern rubber plantations are returned to England and Holland without great damage, they will constitute one of the big economic assets of these nations. It can be expected that very great pressure will be brought on the United States to accept natural rubber in partial payment for the goods that we must supply to those countries. If the cost of synthetic rubber can be sufficiently reduced and its quality can be sufficiently improved, there is at least a chance that it may hold its ground. An intelligent economic policy would preserve our synthetic rubber program to insure that we shall not again be dependent on a remote foreign source for a material so essential in war and in peace; but if this preservation should require subsidy or tariff production, it will meet great opposition from foreign interests and from the professional friends of the common people.

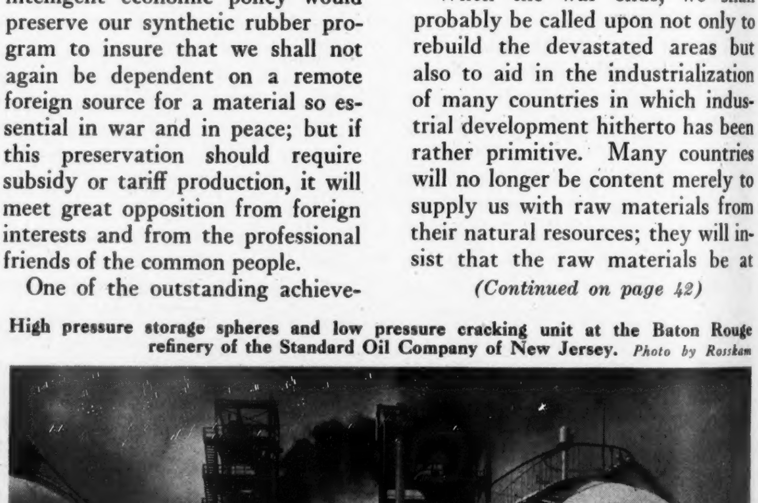
One of the outstanding achievements of the war years has been the development of new pharmaceuticals and allied products. Penicillium, atabrine, the sulpha drugs, "DDT", and the many other products in this field represent a very great permanent advance. The full significance of the recent synthesis of quinine may not be realized for many years. It may be that synthetic quinine itself will never compete with natural quinine; but the recent synthesis may lead to the discovery of new drugs of much greater efficiency and broader use, just as the discovery of sulphanilamide led to the entire new group of sulpha drugs.

One very important group of chemical industries on which attention has been focused by the war is that of food processing. The need for the transportation of large quantities of food for lendlease and for the use of the armed forces has led to the development of dehydrated foods of really satisfactory quality; in this country the "sharp-freezing" of food has attracted broadening interest.

When the war ends, we shall probably be called upon not only to rebuild the devastated areas but also to aid in the industrialization of many countries in which industrial development hitherto has been rather primitive. Many countries will no longer be content merely to supply us with raw materials from their natural resources; they will insist that the raw materials be at

(Continued on page 42)

High pressure storage spheres and low pressure cracking unit at the Baton Rouge refinery of the Standard Oil Company of New Jersey. *Photo by Rosskam*



CARBON DIOXIDE FIRE EXTINGUISHERS

By RONALD M. TAYLOR, M.E. '27

Engineering Department, C-O-Two Fire Equipment Company

CARBON dioxide forms an important part of our fire defenses. It will not support combustion, due to the absence of any free oxygen, and it is this property which is utilized in extinguishing fires. It instantly smothers fires in petroleum products and other flammable liquids; it is safe and effective for use on fires in live electrical apparatus; and, being dry and noncorrosive, it causes no damage to materials, equipment or machinery. When liberated, the gas is discharged from the cylinder by the force of its own expansion and penetrates into the recesses of any space into which it is discharged; hence it is often useful for extinguishing fires in places that cannot be reached with water streams or other extinguishing agents.

As a fire-extinguishing agent, therefore, carbon dioxide is widely used in industry, power generation, aviation, marine and motor transportation and many other fields.

Some Properties of Carbon Dioxide

High-pressure carbon dioxide, as used for extinguishing fires, is supplied in steel cylinders having capacities up to 100 pounds. When a cylinder is filled to 68% of its water capacity, which is the maximum allowable, the internal pressure is 320 pounds per square inch at 0°F., 849 pounds at 70°F., and 2,265 pounds at 130°F. Cylinders are tested and approved for use over a temperature range of from —40°F. to 130°-160°F. The maximum temperature to which a cylinder may be exposed depends upon its type and the design of the pressure relief.

On being released from its container, carbon dioxide expands to 450 times its former volume and is discharged in the form of a dense cloud of gas, resembling steam in appearance. It is usually admixed with some solid carbon dioxide "snow," which varies in amount with the type of discharge nozzles employed. As a gas, at ordinary temperature and pressure, it has a specific gravity of 1.53 with respect to air, and one pound of it occupies a volume of 8.6 cubic feet.

For applying carbon dioxide on fires, two types of equipment are employed: fixed built-in systems, used for safeguarding special hazards of some magnitude, and portable extinguishers, used for safeguarding minor hazards and for general "mobile" fire protection.

Built-In Carbon Dioxide Systems

Built-in systems are of two kinds: "total flooding" and "local application."

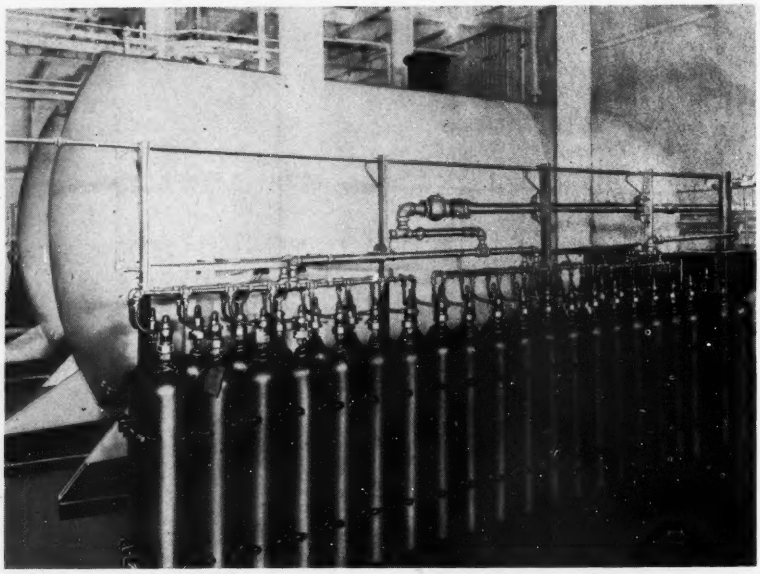
Total Flooding Systems—Total flooding is employed for extinguishing fire within an enclosure, such as a room, vault, pit, or piece of enclosed equipment, and is effected by pouring carbon dioxide into the enclosure until its atmosphere can no longer support combustion. Partially enclosed spaces may be similarly protected by providing the system with pressure-operated trips to close doors, windows and other openings or by installing special nozzles which will screen the opening with carbon dioxide gas when the gas is discharged.

The percentage of carbon dioxide that must be mixed with the air varies with the material involved. Fires in petroleum products cannot live in an atmosphere containing 25% of carbon dioxide; but a concentration of 50% is required in the case of wood, paper and other solid

THE AUTHOR

Mr. Ronald M. Taylor graduated from the Sibley School of Mechanical Engineering at Cornell in 1927. After graduation, Mr. Taylor was associated with the Lidgerwood Manufacturing Company as Service Engineer. He later worked with the Bell Telephone Laboratories as a member of the Technical Staff. For a year he served as director of Feeding & Housing for the Tennessee Transient Bureau at Chattanooga. In 1936 Mr. Taylor joined the Engineering Department of the C-O-Two Fire Equipment Company, after several years in the civil engineering field.

Mr. Taylor



Multi-cylinder installation for the protection of an oil tanker.

combustibles, and 62% in the case of carbon bisulfide.

The equipment employed for total flooding consists essentially of a battery of cylinders containing carbon dioxide, which is connected by piping to nozzles mounted on the wall of the protected space. The cylinders, which may number from one to several hundred, depending upon the size of the fire hazard, are discharged by operating a control mechanism either manually or by means of automatic heat-actuated releases.

With multi-cylinder batteries using "pressure operation" which was developed by the C-O-Two Fire Equipment Company, operating the control mechanism opens the valves of two "control" cylinders, and the pressure of the gas from these two cylinders automatically opens the valves of all the other cylinders for either simultaneous or delayed discharge. This method eliminates the necessity of opening the valve of each individual cylinder, either manually or by some mechanical device. It also streamlines the installation by reducing the number of levers and the linkage required, and simplifies the work of periodic testing.

All pipes and fittings used in a total flooding system must be made of galvanized seamless steel or brass and must withstand a bursting pressure of 6,000 pounds per square inch. The discharge nozzles are of the baffle type, so designed that they ensure rapid expansion and thorough mixing of the gas with the air in the space, without stratification at the lower levels.

With a typical total-flooding installation protecting a space normally occupied by workers, the following sequence of events takes place when fire breaks out in the space.

Operation of the control mechanism opens the valves of all the cylinders, but the gas is not immediately discharged. First, automatic devices actuated by the pressure of the gas sound an alarm warning workers to leave the space, light signal lamps in various locations, shut down all electrical equipment in the space, close openings into the space to prevent loss of gas, and set in motion a time-delay release that controls a valve in the main carbon dioxide feeder pipe. After a pre-determined delay to permit evacuation of personnel (usually 30 seconds), the feeder-pipe valve opens. Then gas fills the space, and the fire is promptly extinguished.

When flammable liquid fires are extinguished by this method, the space may be ventilated and work resumed as soon as the system has operated; but, with materials that tend to smolder, a high concentration of gas is maintained in the space for about half an hour to prevent reignition when air is again admitted after the fire is out.

If the protected space is not normally occupied by workers, the delayed discharge feature may be omitted.

Local Application Systems — Local application of carbon dioxide is employed for protecting localized hazards, where total flooding is unnecessary or impracticable. With this method, the burning hazard is surrounded by a cloud of carbon dioxide, which separates the fire from the air and smothers it.

The nozzles employed for local application are usually of the horn type and must be installed so as to ensure proper application of the discharged gas. Other details of the equipment are similar to those used in total flooding systems without delayed discharge.

Portable Carbon Dioxide Extinguishers

Portable carbon dioxide extinguishers usually put out fires by the local application of the gas, but, when required, they can be used for flooding small enclosures.

They are supplied for hand operation in capacities ranging from 2 to 20 pounds of carbon dioxide; larger units, mounted on wheels, carry from 50 to 100 pounds of the gas; one or more stationary cylinders connected to hose on racks or reels provide large capacity flexible protection for one or more localized hazards; and trucks and trailers, bearing many cylinders and long hose lines, are used for mobile protection against quite large fires.

One-cylinder "local-application" carbon dioxide systems are used to protect paint spray booths.

Applications for Carbon Dioxide Equipment

Protecting Industrial Flammable Liquid Hazards—One of the chief services being performed by carbon dioxide protective equipment is to safeguard industry from the fire hazards created in the manufacture and use of petroleum products and the flammable solvents employed in lacquering, cleaning, chemical manufacturing and other processes.

Where the hazard is unusually severe, as may be the case in such places as gasoline tank-truck filling rooms, oil pumping rooms, rubber mixing rooms, and flammable liquid storages, the entire area containing the hazard may be protected by total flooding.

Isolated non-enclosed hazards, such as laquer and enamel dip tanks, drainboards, oil quenching tanks, etc., are commonly protected by means of local application systems.

Flammable liquid hazards that are not protected by built-in systems may be safeguarded by installing near each a sufficient number of portable carbon dioxide extinguishers, their size depending upon the hazard protected. Portables are also distributed throughout hazardous areas in industrial plants for extinguishing sporadic flammable liquid fires.

Preventing Explosions — Explosions and fires that might occur while heating, grinding, or mixing certain combustible materials or in handling flammable vapors or dusts can be prevented by carrying on these processes in atmospheres having the oxygen content reduced by means of carbon dioxide. The amount of this reduction varies with the material, as shown by the following table:

Material	*Max. Oxygen*
Pittsburgh coal dust	16%
Petroleum products vapor	15%
Grain dust	14%
Wheat starch	12%
Sulfur	11%
Ethylene	10%
Carbon disulfide	8%
Hydrogen	5.9%

Protecting "Water-susceptible" Materials—Valuable products that must be protected from water as well as from fire, such as drawings, irreplaceable records, delicate instruments, etc., can be effectively safeguarded by storing them in vaults which are arranged for "total flooding" with carbon dioxide.

Ducts and Flues—Fires in long ducts and flues are often beyond the range of streams of liquid fire-extinguishing agents, but they can be easily controlled with carbon dioxide. When a duct or flue catches fire, dampers at the end are closed and it is then flooded with the gas.

Protecting Electrical Apparatus—Portage carbon dioxide extinguishers are used for putting out fires in small electrical apparatus; total flooding systems protect transformer vaults, oil switch rooms, etc., and special flooding systems safeguard large enclosed and semi-enclosed rotating units.

Hand size carbon dioxide extinguishers are generally provided for lesser hazards.

The systems protecting the 108,000 kva. generators at the Grand Coulee hydroelectric plant exemplify this type of equipment. Should the internal temperature of any of these generators exceed 185°F., discharge of 1,450 pounds of carbon dioxide into its air spaces and ducts. Then, at the discretion of the operators, carbon dioxide from a "delayed discharge" battery of cylinders is fed in slowly until the rotor comes to rest and the complete extinguishment of all smoldering material is assured.

The rapidity of the discharge is controlled by the size of the nozzle outlets—large orifice nozzles being used for the initial rapid discharge, and small orifice nozzles for the slow and continuous "delayed" discharge.

Marine Applications — Total flooding systems are now generally used to protect the cargo holds of ships, and frequently they are combined with smoke detecting systems. In such instances, air is drawn continuously through piping from each protected hold and carried to a cabinet located in the wheelhouse; if fire breaks out in any hold, smoke from it immediately becomes visible in one of a series of individually numbered windows in the cabinet, which identifies its point of origin. Carbon dioxide is then discharged through the same pipes used for smoke detection into the affected hold and extinguishes the fire.

The smoke detecting cabinet may be equipped to give both visible and audible alarms.

In oil tankers, the hatch openings of the cargo tanks are encircled with a series of nozzles, which screen the openings with a discharge of carbon dioxide in event of fire.

(Continued on page 44)

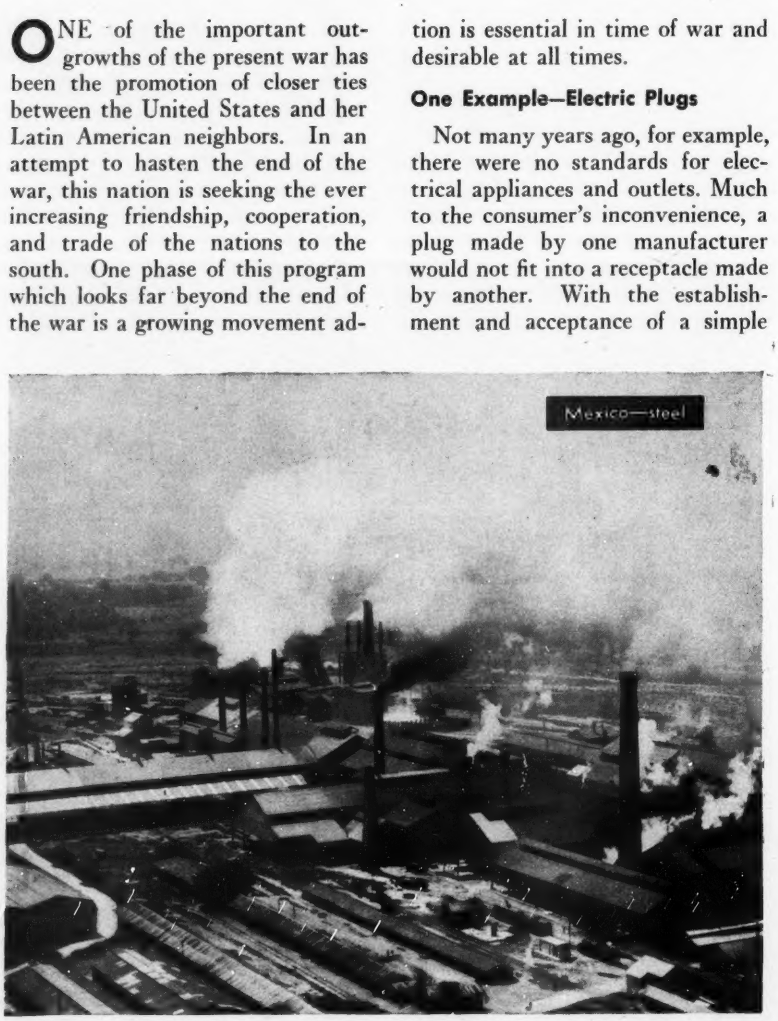
INTER-AMERICAN INDUSTRIAL STANDARDIZATION

By BEN-AMI LIPETZ, ME '47

ONE of the important outgrowths of the present war has been the promotion of closer ties between the United States and her Latin American neighbors. In an attempt to hasten the end of the war, this nation is seeking the ever increasing friendship, cooperation, and trade of the nations to the south. One phase of this program which looks far beyond the end of the war is a growing movement advocating Inter-American industrial standardization.

Essential In War Time

Industrial standards are to industry as standard weights and measures are to the consumer, or as a monetary standard is to trade. It is possible, but very difficult to do without them. The interchangeability of parts and units as a result of industrial standardization is essential in time of war and desirable at all times.



Mexico—steel

One Example—Electric Plugs

Not many years ago, for example, there were no standards for electrical appliances and outlets. Much to the consumer's inconvenience, a plug made by one manufacturer would not fit into a receptacle made by another. With the establishment and acceptance of a simple uniform standard for electrical plugs and receptacles, however, there was a great change for the better. The manufacturers, who had been producing these electrical appliances according to differing specifications and at different costs, began producing, usually with fewer operations than before, interchangeable models of the same basic specifications. The results of this standard were lowered production costs and an increased potential market for the manufacturer, as well as a simplified purchasing problem for consumers.

This is only one example of industrial standardization. Thousands of useful standards have already been accepted in this country which establish standard designs, tolerances, strengths, fits, units, gages, tests, nomenclature, safety codes, inspection codes, etc.

Latin-American Standards

In the countries of Latin America, however, industry is still in its early stages of development, and very few industrial standards have been developed or accepted. The war, cutting these nations off from their sources of manufactured goods, has given great impetus to industrial growth, and consequently many are beginning to feel the need for industrial standardization. Standardizing bodies are in existence in at least four of the more important Latin-American countries, and they are now working harder than ever to develop national industrial standards.

The United States is justly concerned over the decisions of these groups. If one of them adopts a standard which calls for finer workmanship on an item or a different design than our factories are tooled to give, our manufacturers will either lose their market in that land, or, if they retool part of their factories just for that item, their overhead will increase tremendously. On the other hand, if a Latin American standards body adopts a standard which permits manufactures of a quality inferior to that for which American industry is tooled, we will have to sell our high quality goods at a low price to compete with the inferior local product. It is clearly

of vital importance to this country that the industrial standards in Latin America be as similar as possible to those in use here.

The disadvantages of dissimilar standards work two ways, and Latin America is cognizant of the fact. If left to itself, each nation would probably adopt standards similar to those of the industralized country with which it has the strongest ties. This nation, however, would not be the United States. Latin America has from independence looked toward Europe, rather than toward the United States for cultural and scientific initiative. Moreover, before the war many of the Latin-American countries traded with Britain and Germany more than with us. The fact that we use the English system while they use the metric system is another disadvantage.


Argentina—power generation

American Standards

The best way in which the United States can overcome these obstacles and achieve inter-American industrial standardization is to prove that our standards are superior to any others. This would entail having Americans with great technical ability serve on the Latin American standards bodies in advisory or, if possible, voting capacities. The presence of such men and the information they can give can do much to impress our southern neighbors with the usefulness of adopting standards similar to ours.

A very small number of tolerably qualified men were supplied for these tasks in the past by the United States Chamber of Commerce, and by a few American firms with branches in Latin America. Germany and Britain, however, have for years been extremely active in the Latin American standardization movements. Their own national standards bodies maintained permanent advisory commissions in South America, and scores of their firms were represented in the local standards groups. So puny were our efforts in comparison, that in December, 1942 the American Standards Association, observing the need for standardization, took steps to improve the situation by establishing an Inter-American Department devoted entirely to coordinating American and Latin-American standards.


Brazil—transportation

The American Standards Association (ASA), organized in 1918, is a private federation of national organizations which is maintained by business to promote the use and development of standards. Its membership includes technical associations, certain government departments, trade associations, and several thousand corporations. Its approved standards are observed with few exceptions by American industry. Although the ASA is not the only standardizing body in this country, it is probably the most important; the others work in close cooperation with ASA where their fields overlap. The fame of the ASA goes beyond the borders of the United States, and its standards are often consulted in other lands.

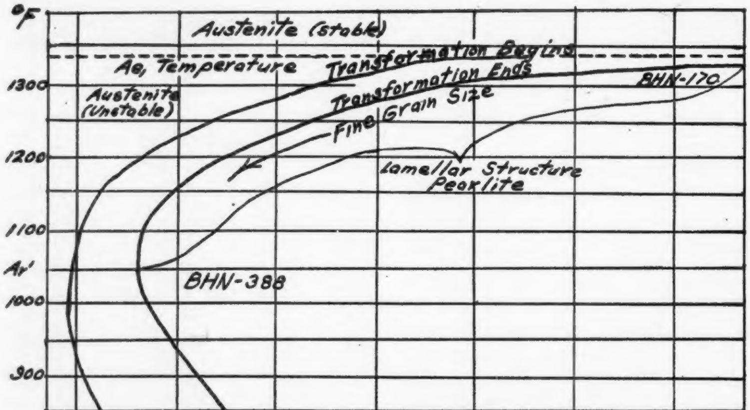
The Inter-American Department of the ASA was organized "to provide so thorough an interchange of technical data that all nations of

(Continued on page 36)

HARDENABILITY OF STEEL

By ANTHONY S. RUGARE, ME '47

STEEL'S ability to harden and the depth and decrement of hardenability are important engineering properties. The hardenability or the hardening power of a steel is a measure of the capacity of a steel to avoid transformation into soft products at slower and slower cooling rates regardless of the hardness in the martensitic state, which is a function only of the carbon content. This hardness is related to the tensile and torsional values of steel, and consequently in any machine part where strength or resiliency are essential factors knowledge of the hardenability of the steel to be used is extremely helpful. Steels which harden too deeply might become excessively brittle, whereas steels having shallow hardening might fail due to fatigue or low strength. It is the purpose of this article to discuss some of the characteristics of hardenability and a method of measuring hardenability.



"S" Curve for 0.89% Carbon Steel

The degree of hardness obtained in any steel as a result of heating and quenching is dependent primarily upon how fast the steel is cooled during the quenching operation. Grain size, carbide condition, and alloy content tend to modify the hardness obtained at some one rate of cooling. For instance, the coarser the grain in the steel just before it is quenched, the deeper it will harden. The presence of manganese, molybdenum, or chromium in a steel is an excellent step towards increasing hardenability. But for any steel of a particular composition, grain size, and carbide condition the rate of cooling alone, with the possible exception of cooling stresses, determines the hardness produced.

Effect of Cooling Rate

It is known that increasing the cooling rate lowers the apparent temperature at which gamma iron changes to alpha iron and simultaneously rejects carbide, and that it also alters the rate of this change. With moderately fast cooling, the transformation temperature is lowered from 1300°F. to a range between 900-1100°F. From the so-called S-curve, which plots the logarithm of time against transformation temperature, it can be seen that the time needed for austenite in the unstable state to be transformed into fine pearlite at a temperature of 1050°F. is only one or two seconds. Therefore, in order to form martensite and thus have a completely hardened steel it is necessary to have a cooling rate fast enough to suppress the rapid transformation of austenite to fine pearlite at 900-1100°F. For small sections of high-carbon steel, quenching in cold water will completely suppress this transformation and the object hardens throughout. In large sections, however, quench-

ing in cold water only results in shallow hardening. The problem now comes up of trying to find ways to cause steel to withstand changes into soft products at slower and slower cooling rates.

The problem finds a partial solution in the control of alloy content and grain size of steels. It is the nature of dissolved elements in austenite to slow down the transformation velocity (not true for cobalt), making possible the hardening of alloy steels with slower cooling rates. This is an asset in preventing the distortion of certain hardened steel products, for it allows the use of a less drastic quenching medium than water, thereby reducing internal stresses. The most effective elements in increasing hardenability are manganese, chromium, and molybdenum. Since the transformation of austenite into ferrite and precipitated carbides starts at the grain boundaries of austenite, it follows that a steel having a coarse austenite grain size will have a higher degree of hardenability than one with a fine austenite grain size because there is less austenite in the grain boundary region for larger grains.

One might ask if there is any difference in the hardenabilities of cast and wrought steels. The only difference which may occur is caused by a slight modification in analysis. Commercial cast steel will in general be more hardenable than commercial wrought steel of the same carbon content due to the higher silicon, aluminum, and sometimes manganese contents of cast steel, since all cast steels are dead-killed steels; i.e., during manufacture a deoxidizing agent such as ferro-manganese, spiegel-eisen, ferro-silicon, or metallic aluminum is added to degassify the molten steel. In practice this slight difference in hardenability is compensated for by lowering the carbon content of cast steel not more than 0.05%. Roughly speaking, there is no difference in the hardenability of a steel just because it is cast or wrought.

—Courtesy Bethlehem Steel

Close-up of the Jominy test showing how the water spray touches only the bottom surface of the test piece.

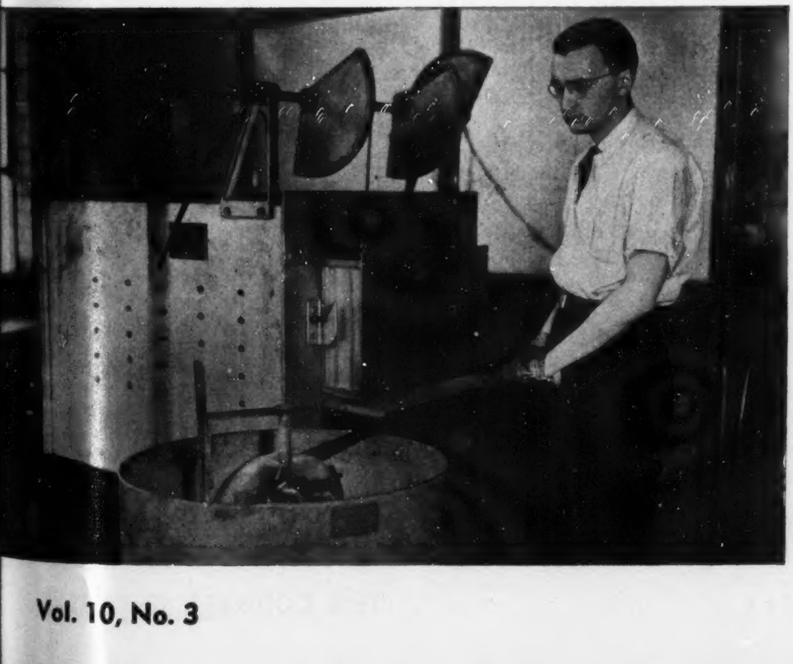
As the principles of hardenability have become better understood, various methods of measuring the degree of hardenability have appeared. One of the earliest tests, the Shepherd test, rated the steel in terms of the hardness penetration in a ¾-inch round specimen, quenched in a brine solution. A proposal to describe hardenability in terms of the size of a round bar which would just harden to the center when quenched with the ideal quench was made by Asimow, Grossmann and Urban. Queneau and Mayo proposed that hardenability be expressed in terms of a line showing the depth to which a steel would harden in various sized round bars. The most popular test was to quench a heavy round specimen, section it, and make a hardness traverse across the section. The bars were cut tranversely midway between the ends under water with an abrasive cutting wheel. Hardness results were plotted as ordinates and the abcissa represented the diameter. A deep hardening specimen would show little variation in hardness across the diameter compared to a shallow hardening specimen.

All of the tests mentioned are overshadowed by the end-quench hardenability test, or as otherwise

(Continued on page 34)

The end-quench hardenability test. Piece is quickly removed from furnace, placed in the forked holder, and the water stream is started.

—Courtesy Bethlehem Steel



PROMINENT

—*Photo by Dulaff*

"Long John"

John P. Fraser, ChemE

"WELL," said "Long John" as he settled his six-foot three-inch frame back in a chair and looked wistfully westward, "there was really one thing that convinced me that an engineering education was essential if I were to go on living a happy and peaceful existence."

And so began the story of John P. Fraser's life. A story which we darn near had to blast out of him, for it seems that some of the quiet and reserve of his native Nevada has seeped into the bones of the tall chemical engineer—at least when it comes to talking about himself.

"Yep," he continued, "although I'd often considered engineering as a life-time profession, it was an incident that happened while I was in high school that really decided things.

"You see, another fellow and I were making a trip across the desert to my father's gold mine, which is located about forty miles from Lovelock, Nevada, when the darn car stopped. We didn't know why it stopped—it just quit cold. And so we both got out and tinkered with it a while, but knowing nothing about the motor, we weren't able to do much. My pal suggested we turn a little knob and see what happened. We did, and a steady stream of gasoline resulted. Not knowing anything better to do, we just let it drip for a while, catching the gas in an old can, and then we tried to start it again. No luck.

"Night was coming on, and we were a helluva long ways from the nearest town or mine or anything human—and believe me, that des-

(Continued on page 46)

Edmund T. Cranch, ME

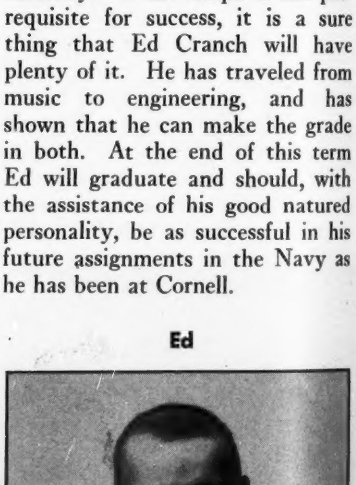
EDMUND T. Cranch, a graduating senior of the Sibley School of Mechanical Engineering, sat back leisurely in his chair and quietly answered the biographical questions fired at him amid the sprawling experimental equipment of the photo elasticity lab. Unlike Ed's unassuming, almost shy manner, his story is that of a double personality—one musical, and the other scientific. He was born in Brooklyn, where he lived for only three months, later moving to Larchmont, New York. After tweleve years he again moved—to Westfield, New Jersey. Originally Ed's principle hobby was the trumpet. He played in his high school band in addition to the baseball and varsity hocey teams. However, neither music nor sports interferred with his becoming one of the honor group in his high school graduating class. While still in high school, Ed took up the trumpet as a vocation, playing for a time in a dance band. Working for the Metal and Thermit Corporation, he later became quite interested in Engineering. Although he had few science courses in high school, Ed was held to an interest in Engineering by the desire to know all the fundamentals behind the work he was doing.

Ed enrolled in the Newark College of Engineering. But after the outbreak of war, in 1942, he enlisted in what was then the V-1 program. After only five weeks of his Junior year at the Newark College of Engineering, Ed was ordered to Cornell, where he is now studying Mechanical Engineering in the V-12 program. Maintaining a Dean's List average in the M.E. School, he is Vice President of Tau Beta Pi and also a member of the American Society for Metals, and a member of the Newark chapter of the American Society of Mechanical Engineers. Ed is active in such sports as tennis and ice hockey. The one part of the V-12 program which Seaman Cranch likes most is the fact that it has acquainted him with fellow V-12'ers from all over the nation, and from many different schools and colleges, giving him an insight into the varied qualifications of schools and districts throughout the country.

After the war Ed thinks he will become a graduate student in mechanics, as there are many special subjects and courses which he wishes to study more extensively before completing his formal education. After getting his Master's degree in mechanics and trying a little metallurgy on the side, as he puts it, he believes he will try to find work in the field of photo elasticity, stress analysis, or metallurgy.

Ed believes that success can be found only by concentration, hard work, and an extra bit of mental curiosity. If his recipe is the prerequisite for success, it is a sure thing that Ed Cranch will have plenty of it. He has traveled from music to engineering, and has shown that he can make the grade in both. At the end of this term Ed will graduate and should, with the assistance of his good natured personality, be as successful in his future assignments in the Navy as he has been at Cornell.

Ed



ENGINEERS

Ed Kornhauser, EE

ALTHOUGH it was a friend going to Georgia Tech who pesruaded Ed Kornhauser to study Electrical Engineering, the reputation of Cornell's EE School made him decide to come here in June 1942. Ed, his full name is Edward T. Kornhauser, attended All Male high school in Louisville, Kentucky, his home. He was editor of the senior yearbook, played a trumpet in the high school band, and upon his graduation as Salutatorian of his class, was awarded a McMullen Regional Scholarship.

Ed was a civilian at Cornell for three terms before he entered the V-12 program, and he well remembers the social life of those "good old days." In his Freshman year Ed made the Dean's List and he has been on it ever since. He joined Phi Kappa Tau in his second term.

Ed is a member of Tau Beta Pi, honorary Engineering Society. He was elected to Eta Kappa Nu in his Junior year, was later elected corresponding secretary, and is now president of this honorary EE Society. He also belongs to the Delta Club, an EE social society, and the AIEE.

Ed's favorite sport is tennis, and he likes mathematics and the study of physical phenomona. He is particularly interested in electronics equipment. Ed says the EE school isn't too hard, but there is a lot of work to do. Because of the accelerated program, he feels there isn't enough time for the student to see the relationship between courses and their applications.

Ed

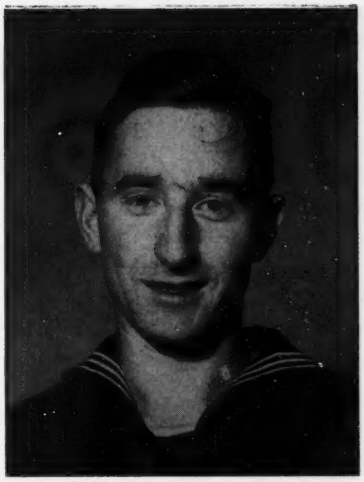
Ed hopes that in the future engineering schools will be on the same basis as law or medical medical schools, where there is a period of fairly general college education before the student begins to specialize. This, he feels, would give engineers a much needed liberal background.

After receiving his commission, Ed hopes to be sent to radar school. Following his discharge from the Navy, at the end of the war, he would like to come back to Cornell and continue his Electrical Engineering studies, along with some research work.

Roland P. Allen, CE

"I COULDN'T quite see myself an EE, so I took CE," is the way Roland P. Allen, invariably called "Al" by his classmates, explains his debut into Civil Engineering. When he entered Virginia Military Institute back in 1940, he discovered that the only engineering courses they offered were EE and CE, and he chose the latter, although his dad told him never to become a CE.

Long before he made that statement, Al was born in Dallas, Texas; just twenty-one years ago. "Unfortunately," he said, "I didn't get a chance to do much cattle roping as we moved out of Texas when I was three. He went to grammar school in Boston, and to high school at Cairo Central School in Cairo, New York. Then he entered VMI where he stayed a year. He had to leave and go to work when his father died in 1941. He ended up in Albany as a laborer on a truck gang and in Scotia as a warehouseman. Not long afterward, he was drafted into the Navy ("First Navy draft," he explains, 'I'm first in everything."). Allen hoped to



—Photo by Dulaff

Al

enter the V-5 program, but his hopes were shattered in boot training at Sampson. After five months there, ready to leave for action, he was selected for V-12 training and sent to Cornell, which he entered in July '43 with the first V-12 contingent here. He received two terms credit for his work at VMI, and is now in his seventh term.

Cornell, it seems, is "right up Allen's alley." During his two school years here, Al participated in quite a number of activities. He is on the varsity soccer team, was in varsity wrestling, is active in ASCE, is a member of Chi Epsilon and Tau Beta Pi, and is vice president of Pyramid society. After his fifth term, Al made the Dean's list. Although only a beginner, he professes an interest in photography, and has a 35 mm. camera with which he takes shots of the campus when he manages to accumulate enough film.

After graduation Allen hopes to get into the Sea-Bees. As he will have only a BSCE degree, he intends to return to Cornell after the war for his BCE—and also to see what Cornell is like in peacetime.

Al still doesn't know in which field of Civil Engineering he'd like to specialize, especially since, after he finishes a course in which he thought he had no interest, he often finds he likes that too. He knows he likes Civil Engineering, though, as he wants to work out of doors, something which he believes is common in that profession.

"I just get started doing one

(Continued on page 46)

Engineering At Cornell

2. Electrical Engineering Laboratories

By LAWRENCE W. SIMMONS, EE, V-12

ONE of the more important group of engineering laboratories on the campus are those of the electrical engineering school. The EE group consists of four labs. The first of these is the power or machinery labs of which there are two sections: one located in Rand and the other in Franklin. The second, the electronics lab, is located in Franklin. The third type is the communications lab, is also located in Franklin. The fourth is the high voltage lab, located off campus in the southeast section of town.

The purpose of these labs, aside from depriving the students of sleep by keeping them up until the wee hours of the morning writing the reports, is to let the student run tests on and handle the equipment he studies in theory courses. The labs are all well equipped to give the student a thorough working knowledge and applied theory sufficient to meet the demands of his special field. Every engineer in order to meet the requirements for a degree must take at least one electrical engineering lab.

Of the most general interest, at least from the standpoint of enrollment, is the electrical machinery laboratories. Here the students study electrical measurement, A-C and D-C motors and generators, controllers, rectifiers, transformers and other problems and devices concerned with the conversion of electrical power into mechanical power or vice-versa.

The machinery lab in Rand is devoted entirely to electrical engineers and to special classes of the Midshipmen's School at Cornell. The present enrollment is 160 V-12 and civilian electrical engineers and 75 midshipmen in the steam engineering course.

The present branch of the lab, brought over to Rand about thirty years ago, is a modern electrical machinery lab equipped with standard machinery, wide in scope and variety so that the student may get a thorough training in the fundamentals of power engineering. The university has been training naval officers and midshipmen for some time in its class rooms. Since the beginning of the naval training school at Cornell the navy has built its own diesel lab, but the steam engineering courses are still conducted in the university labs and class rooms. About fifty per cent of the so called twelve week steam engineering courses consists of electrical engineering, for which the lab is given in Rand. The work in this connection is more specialized than that of the regular college courses and is designed to increase the suitability of the midshipmen as engineering officers.

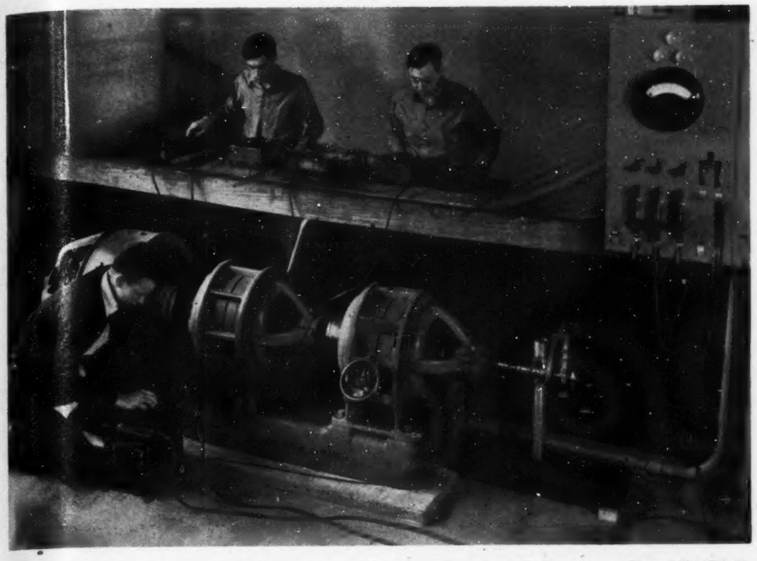
The secrets of various circuit arrangements are investigated by teams of students working at laboratory equipment tables. *Photo by R. C. Reese*

The undergraduate curriculum of the lab consists of four courses required by both V-12 and civilian electrical engineers. The first of these courses given to the student is Electrical Measurements, followed by D-C machinery and Storage Batteries, D-C and A-C Circuits, and Advanced A-C and D-C Machinery.

The other section of the machinery lab located in Franklin is now used for the courses for the mechanical, chemical, and civil engineers. It is here that the mechanical engineers take their much beloved 405 and 406 courses. Although the lab is not used by electrical engineers at the present time it was the original electrical machinery lab. The two machinery labs work in close cooperation, and while the equipment and set ups vary somewhat the labs and the courses are in general somewhat similar.

Also located in Rand is the instrument standardizing lab. Here the standard resistances and standard cells are kept under controlled conditions together with extremely fine instruments for the standardization and calibration of secondary instruments.

The electronics lab is one of the newer labs in the university having been born in February 1936. While electronics is not a new development, its industrial application is a relatively recent development and great strides are being made for the improvement and uses of electronic equipment. Consequently it receives much popular attention, although as a course it probably receives as many curses and is just



Students conducting practical dynamo tests in the Electrical Laboratory, Franklin Hall.

as difficult as any other course.

Radio and electronics are sometimes used as somewhat synonomous terms, but radio is only one application of electronics. Another field of great importance and one that is rapidly expanding is that of electronic controlling devices in industry. For that reason electronics is a required course of the navy for all electrical and mechanical engineers. It is a prerequisite for communications courses and therefore communications students take the course which consists of two terms of lab and theory courses in their junior year, while the other students normally take it during their senior year.

The original lab started out with 25 students, and the present enrollment is 88, but the sections are expected to double during the next year since by that time many of the navy students will have reached the terms in which the course is required. After the war Prof. Northrop believes that one of the greatest expansions in technical education will be in the electronics field. In fact a plan is under consideration to add an industrial electronics option to the available power and communications options, now taught in the school of Electrical Engineering.

The electronics lab is constantly getting new equipment both to keep up with the science and to meet the growing demand for training. Some of the newer equipment includes welding controls, mercury arc rectifier, and a high frequency heater. New motor controls are expected together with other equipment used in the study of the basic control circuits in industrial applications.

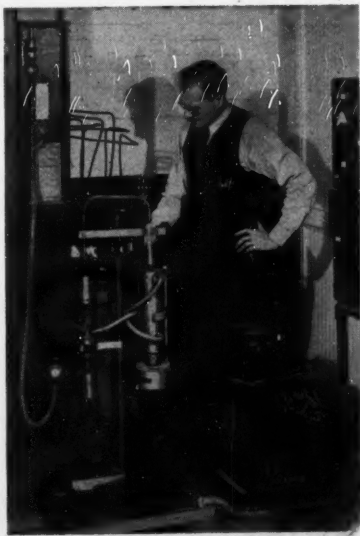
While the electronics lab takes up the theory and industrial applications of electronics, the communications lab takes up the study of the application to the field of communication. There are 22 men actually coming to the lab now, but a considerable increase will result when the V-12's of the first class come into their senior year, at which time those in the communication option will take the two terms of lab work. In the lab and related courses the students study and conduct experiments pertaining to frequencies from zero (direct current) to billions of cycles per second in connection with the ultra high-frequency work of radar. Such devices as the ultratron and magnetron are studied. Although the standard lab consists of two terms of work, there is an interesting supplementary, which is known as the projects lab. Here the students actually design and test the apparatus which they choose as a project.

In discussing the communications lab WHCU deserves some mention, although it probably speaks for itself especially to those Cornellians whose worn out but irreplacable radio tubes make this the one and only station they hear. The original equipment was a joint gift of Westinghouse and General Electric to the university. At first it was primarily a technical experimental station, but due to pressure from the FCC as to license requirements, it has for the past several years been operating full time. It is now self-supporting although it still comes under the general jursidiction of the university. It is still used for demonstration and for some experimental work which does not interfere with the commercial requirements. After the war the university expects to build a station for F-M broadcast.

The high voltage lab is primarily a testing and research lab. Some demonstration work is conducted here, but the primary work is in testing commercial apparatus and in research experiments. Surge voltages as high as 3,000,000 volts, open circuit, and A-C voltages as high as 750,000 volts may be produced. Transformers and insulation may be tested and the effects of high voltages and lightning on materials and transmission lines may be studied.

Looking at the picture as a whole, Cornell is fortunate in having the well equipped and staffed electrical laboratories that it does. The labs are constantly receiving improvements for the study of fundamental concepts, as well as modern developments and applications.

"Cornell is fortunate in having the well-equipped and well-staffed electrical laboratories that it has."



Tau Beta Pi Essays

On Rowing

By Lon F. Israel, Jr., ME '44

"COXWAINS! Bring your shells up to the stake boats!" There's a last nervous moment, removing excess clothing, checking stretchers, screws and laces.

"Are you ready Navy?" The middy cox drops his arm signifying Navy is ready.

"Are you ready Princeton? Are you ready Cornell?"

Your cox shouts, "Ready all!" You check everything again in a split second, and you dampen your hands; but they are already wet from perspiration. Your heart beat seems to stop, your stomach develops that uncomfortable, sinking feeling; now suddenly you wish you were ashore—an onlooker. Suddenly, "Are you ready all?" Your muscles become very tense; but you must relax. "Relax and think," those were the coach's final words.

"R-E-A-D-Y A-L-L!" Then, you don't see it, but in the second boat over, a coxwain's arm shoots up: mechanical failure! It must be repaired; so another few tense moments are at hand. You turn around to the man behind you, speak confidently, appear nonchalant. You've done it many times before; it's only another screamer. What you're trving to do is to convey your confidence to the other men in the boat, because you realize the vital importance of this intangible. Then, as suddenly as before, "Are you all readv? R-E-A-D-Y A-L-L?" "ROW! ! " It is this word, and this word alone, which vou have listened so carefully for. You hear it distinctly; you react instantly; and yet, afterward, you can't remember any of the events of the first few seconds. All your actions are mechanical because you have trained for months for this very moment and those to follow.

It is impossible to describe the ·vchological effects and emotions ·ienced at the start of a crew ·ervousness, fright, thrill. Perhaps that's what makes crew so exciting.

The body of the race, win or lose, is a separate experience, or series of experiences, in itself. It can be a nightmare of mishaps, a failure; or it can be a thrilling and highly satisfying experience. In the last quarter-mile you become completely exhausted, you are certain you can't row another stroke, but you do—you row it all well—even better than the first part of the course. Men have been known to faint from exhaustion, tear arm muscles from the bone, rupture themselves; all of which pretty well describes the "sprint," as it is called.

Why is it that men work every day for months, go through long hours of fatiguing practice, struggling incessantly for form, smoothness, and a thing called a "swing?" Is it worth it? To you who are skeptical I say, "Ask any old crew man." Ask him why he keeps rowing year after year if it's such hard work? Or perhaps in prewar days you could have attended the Poughkeepsie Regatta on the Hudson. You would have noticed an eagerness felt nowhere else, the enthusiasm of the oarsmen to hit the water. Their enthusiasm is not something new. Rowing is one of the oldest sports in existence. Regattas in America and England have continued to draw their particular crowd of fans for generations. Ardent followers and old oarsmen always love a good race. But to enjoy it, as in any sport, one must be educated to its elements. Many of the boys rowing on college crews will continue to row on club crews after graduation and will always maintain an active interest.

The pleasures derived from a crew race are concentrated in the ten or twenty minutes of the race—a short time which is action packed with thrills. Crew is a developer, physical and mental, which is difficult to match. It teaches coordination, control, and clear thinking under pressure.

True, other sports have surpassed it in importance or popularity, but it will never cease to have tremendous appeal for those few fortunate enough to have had the experience of rowing with a crew.

A man elected to Tau Beta Pi, national engineering honorary society, is required as one of his pledge duties to write a short essay on a nontechnical subject.

The CORNELL ENGINEER *takes pleasure in publishing this month three essays from those submitted during the last year.*

These papers have one characteristic in common. All of them illustrate the fact that an outstanding engineer, in addition to technical proficiency, needs a breadth of interest extending into other fields. He must be able to find satisfaction in pursuits outside the boundaries of his profession if he is to become a truly well-balanced man.

Man—His Own Slave

By Malcolm R. Rankin, ChemE '44

AS I walked down the street the other day, I noticed a puppy capering on a lawn. I unconsciously snapped my fingers, and he came bounding over to say hello. He did not stop to make sure that I was not a Jew or a Negro. No, his action was simple, direct, and free. Now, suppose that I acted like the puppy did and approached a stranger, smiled at him, shook hands, and offered him a cigarette. His immediate reaction would be to watch out; he would think I wanted something; his vote, the use of his lawn-mower, or a loan of money. The stranger is accustomed to encountering spontaneous friendship only in dogs. He trusts

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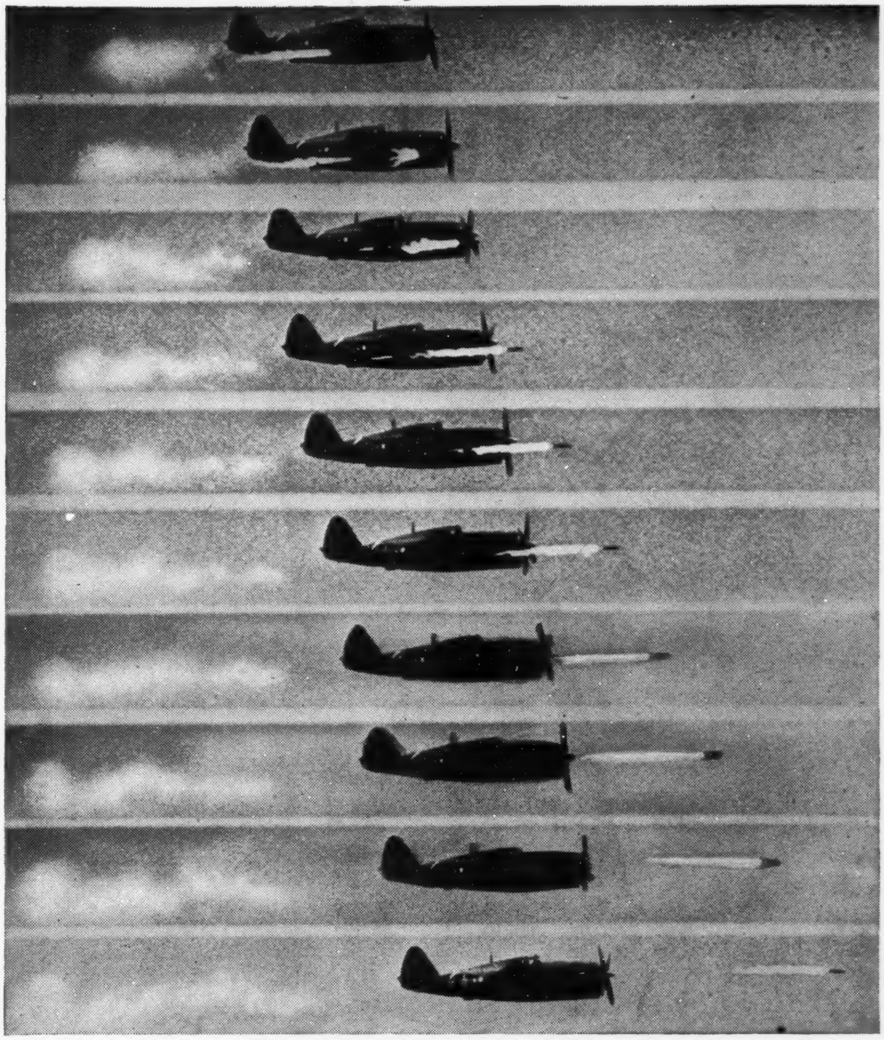

Dedicated to ye ancient and honourable society of ye chemicale engineers in ye belief that Chemicale Engineering is ye one, ye only art.

"Caustic"

By JIM EDISON, ChemE, V-12

THROUGH the years of the CORNELL ENGINEER'S publication, the name of the dean of the Chem E's, has often graced our pages. The latest tale of the incomparable Dusty, which we have from the lips of the great man himself, concerns a homecoming of a few years ago.

At the time, it seems, the custom was for all of the returning alumni to dress in overalls, old straw hats, work shoes, etc., so that for a few days it really looked as if the hill had gone back to the farm in a big way. It also seems that Dusty had a very important engagement, and as he hustled through the halls of Baker (Olin was not built then), he was continually interrupted by overalled old grads who would rush up, pump his hand, and ask inane and time-consuming questions as only old grads can. Finally as he entered his office and espied another vaguely familiar character in overalls, he figured on playing it cagey and cutting this old grad off fast. Never giving the other man a chance to get a word in, Dusty ran up to him, grabbed his hand, asked after his family, and inquired how the chemical engineering was coming along. Paying no attention to the man's surprised expression or mumbled answers, the dean continued to pump his hand and worked him towards the door. After promising to see him again and have a long talk, Dusty gently, but firmly, propelled the other man out, and closed the door with a sigh of relief. Turning, he found his secretary and staff doubled up with laughter—you guessed it, the "old grad" was the janitor from Sibley whose embarrassment could have been exceeded only by that of Dusty himself.

CHEM E'S LAMENT

Of all the words
Of tongue and pen,
The saddest are these—
710 * * *

EVER since about December 7, 1941, advertisers in almost any magazine you care to pick up have been making a big play of letters, supposedly written by G.I.'s, in which the G.I. outlines just what he is fighting for and what his plans for the future are. A sample of this particular type of garbage which recently appeared in a widely-published magazine is:

"Dearest Mom; So old Bess has pups again . . . She had her last litter two years ago—just about this time of year—when everything was so fresh and new. That's what I want to get back to . . . that world back home where a fellow can give the sort of welcome he ought to give to a litter of setter pups in the spring. To watch them group up with all the other new, young things in a world that's bright and free . . . Your loving son, Bill."

We are particularly nauseated by these touching bits of hogwash; but we figured that since we are 5000 miles from the nearest front, maybe we couldn't appreciate the way the fellows there felt about the "new, young things." However, our faith in the intelligence and balance of the G.I. was vindicated by the following item in a service paper, *Le Tomahawk,* written by a boy who had also read the foregoing advertisement. It states pretty much the way we feel about the whole thing.

"We think it's high time the copy writers learn that this war is being fought by grown men," he wrote. "We are fighting because our country is at war and for reasons that grown men understand . . . But since the public seems to think that soldiers are simple asses, drooling slush in the face of machine-gun fire, we offer the following copyrighted 'Dear Mom' letters direct from the front:

"Dear Mom: We are camped in an orchard not far from Carentan that you've read about, Mom, and there are dairy cows grazing in our orchard and the peasants come right out in their wooden shoes and milk them, and Mom, one of the cows made fertilizer right where I put my blankets down. Golly, Mom, it sure smelt good and reminded me of you and Dad and old Muley. That's what I'm fightin' for, Mom, a world in which there won't be no soldiers putting down their blankets right where old Muley wants to make fertilizer. Your loving son, Junior."

"Dear Mom: We were going through some hedgerows toward Saint Lo today, Mom, and a German burp-gun got on me and I ducked in a ditch and set off a Teller mine, and a Tiger tank ran right over my ditch, and a squad of Boche infantry started heaving fragmentation grenades at me and I got to thinking, Mom, of old Bess and her about to have pups again, and Mom, we can't have them pups born into a world that ain't free and bright, can we, even if it's the way you said old Bess got out that night and was bred by that mongrel next door, so Mom, I got right out of my ditch and fixed that tank good and proper, and also the burp-gun, and the Boche infantry, and we will get this here war over, Mom, just as soon as we can for you and Dad and old Bess, and a better, brighter world for that unborn litter. Your loving son, Henry."

Pardon us while we go york.

Cornell Society of Engineers

107 EAST 48TH STREET **1944—1945** **NEW YORK 17, N. Y.**

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Mr. Savage

"The objects of this Society are to promote the welfare of the College of Engineering at Cornell University, its graduates and former students and to establish a closer relationship between the college and the alumni."

President's Message

WITH National Elections behind us it now is apparent that the policies of the government are to continue along the lines the Administration has been sponsoring. This means more New Deal, more pro-labor policies and perhaps legislation, a further liberalization of our political philosophy and thinking and a newer concept of what the economic order of the post-war America is going to be. It is my opinion that no profession is going to be more affected by this trend than the engineering profession. I believe it is high time for the engineer to come out of his secluded world of blue prints and like a new born chick, take a look at these forces that are destined to change not only his life but his work and the tools he uses.

After appraisal, then comes the important question: What are we as engineers going to do about it? Are we going to let organized minorities with no regard for the welfare of the engineering profession control our destinies and tell us what shall be good for the engineering profession, or shall we take this responsibility on our qualified selves and determine what is proper for our own welfare? The results of progress and accomplishment in engineering are indictments that can be levelled at the engineering profession, but this we accept as we can point to numerous monuments to engineering skills in every field of endeavor. However, the indictment of what the engineering profession has done to help itself in establishing and maintaining its value and integrity with organized groups, be they majorities or minorities, to the end that the profession be left alone to determine the needs for its welfare, is on the conscience of every engineer regardless of his affluence or influence.

The engineer can no longer overlook his previous lack of interest in the affairs outside his profession. True also, his own house must be in good order, but this has already been well established despite the distant rumblings of whether engineers shall be unionized and whether various degrees of engineering skills shall have a pre-determined salary schedule in any given field of endeavor. These inroads affecting the integrity of our professional status must be resisted at every turn if we are to hold our status as a profession. That is why engineers must be constantly on the alert to protect the sanctity of our profession by not only keeping faith with our code of professional standards, but by vigorously emphasing to other economic groups who might otherwise seek to control our destinies, that the engineering profession is an absolute necessity to the welfare of the public and, as such, is honestly entitled to the high place in the sun that it has earned, and that we are perfectly capable and ready to determine what is of the best interest to the engineer and his profession.

The various state licensing laws and the Professional Engineering Societies arising therefrom, the four major professional societies supplemented by other organizations of engineers such as our society can be bulwarks in protecting the interest and status of the engineer. All such groups, however, should crystallize their action into a powerful organized unit so that when it speaks, the authority behind it compels the action suggested.

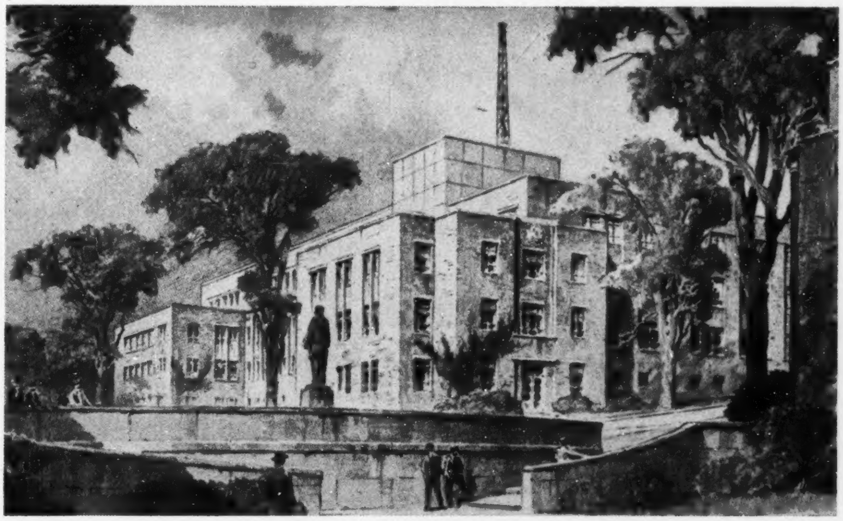
It is with concerted action such as is suggested herein that the integrity of the engineering profession may be maintained despite the actions and viciousness of well organized opposing minority groups. As engineers we should do this and more; we should take our proper position in other places in our economic and social order and give the public the benefit of our judgment and guidance consistent with our training as engineers, where we have learned to base our judgment on carefully evaluated facts. Better think this over and after thinking it over—do something about it, because if you don't you are not only kidding yourself, but breaking faith with your fellow engineers who are following through.

BERNARD A. SAVAGE, M.E. '25

Cornell's New Engineering College Campus

SITUATED at the south end of the campus, it will occupy some twenty-two acres. The planned group of buildings of the College of Engineering will provide the very latest in laboratory and classroom facilities, functionally integrated for most effective instruction.

SCHOOL OF ELECTRICAL ENGINEERING



The proposed new **School of Electrical Engineering** will be located on the present site of Sage College. It will house thoroughly modern laboratories for instruction and research in electronics, communications, illumination and power, as well as the required class and lecture rooms.

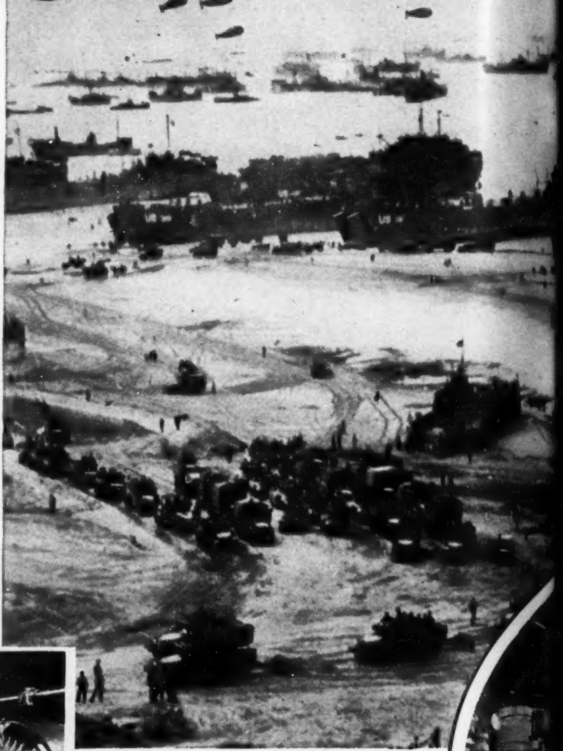
This structure, together with the High Voltage Laboratory and the Broadcasting Station already in operation, will provide excellent facilities for the teaching of electrical engineering in all its important divisions. Construction will be undertaken as soon as funds become available for this unit of the new engineering group.

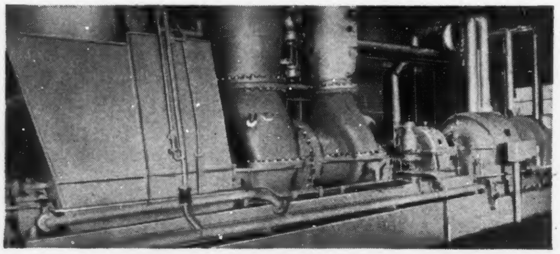
S. C. HOLLISTER, Dean
College of Engineering
Cornell University

“MADE IN AMERICA” IN THR ORT

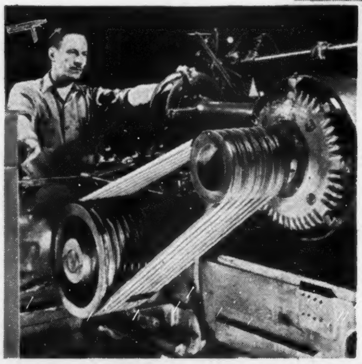
Man’s Mightiest W r

How Allis-Chalmers engineering and equipment helped U. S. Industry solve the biggest production problem of all time...3 important A-C developments that greatly speeded the job!





1. **A-C GAS TURBINES** in U. S. oil refineries helped mass produce super aviation fuel for Uncle Sam’s fighting planes. Called “first really new kind of power plant in 50 years,” gas turbines are already predicted for locomotives, ships, many other post-war machines.



2. **MULTIPLE V-BELTS,** invented by Allis-Chalmers, drive 75% of all U. S. machines turning out weapons of war. Since 1941, thousands of guns, tanks and planes have been produced with their help—*with tremendous power savings!*

3. **A-C MERCURY ARC RECTIFIERS** were important factors in breaking the aluminum bottleneck after Pearl Harbor. They provided a cheap, fast way to convert alternating to direct current for mass production of aluminum and magnesium for war planes. Helped build the air armadas that blast the way for U. S. invasion troops!

“ENGINEERING THAT AIDS ALL INDUSTRY FURTHERS AMERICAN GOOD LIVING”

OVER 1600 PRODUCTS

Supplying the Worl arges Industri quip

ALLIS-C AL

THR ORT YEARS—

W r Machine!

NEXT STOPS Manila—Singapore—Tokyo—for America's War Machine! You'd never recognize the war fledgling of 1941!

Back of our rapid military growth, stands U.S.A.'s unique ability to produce almost anything faster than any other nation. To this ability, Allis-Chalmers has made many important contributions that help speed war output in almost every branch of industry. In post-war plans, call on this vast industrial experience to help solve production problems—effect vital peacetime economies!

VICTORY NEWS

New "Streambarker" for Paper and Pulp Mills. First hydraulic barker ever designed for standardized production, Allis-Chalmers' new Streambarker not only eliminates hand cleaning of pulpwood logs but saves man-hours and money for mill operators by completely eliminating pulp loss from "broomed" log end.

Secret is water under 650 pounds pressure which removes bark as logs are revolved and propelled through the Streambarker. It handles logs 4 to 8 feet long, 4 to 10 inches in diameter. Write for Bulletin B-6341.

Hunting Defects is His Business! The man above is giving A-C motor shafts the "eagle eye." It's true he doesn't find many defects. But none that are there get by him!

Careful inspection of all parts is one more reason why you can depend on Allis-Chalmers motors for long-life performance!

New 80,000 kw Giant Bids for Record! So satisfactory was the first Allis-Chalmers 80,000 kw steam turbine generator installed at Port Washington, Wis., that the power plant became known as the "World's Most Efficient."

Today, Port Washington has a "sister" A-C turbine of same kw which promises to exceed even the original in performance due to modifications in design which increase capacity and reheat temperatures. By shipping sub-assemblies direct to the sites for field erection, commercial operation of this turbine was possible 60 to 90 days ahead of normal.

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

FOR VICTORY
Buy United States War Bonds

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tria quipment—

ALMERS

TUNE IN THE BOSTON SYMPHONY ORCHESTRA
8:30 P.M. E.W.T.—SATURDAYS

BLUE NETWORK—COAST-TO-COAST

ALUMNI NEWS

L. E. Gubb, '16

LARRY E. Gubb, chairman of the board of Philco Corporation, Philadelphia, was elected a trustee of Cornell University on October 13, by the board of trustees, chairman Howard E. Babcock announced. Re-elected trustees by the board are Victor Emanuel, president of Aviation Corporation, New York City, and Walter C. Teagle, Port Chester, Conn., former chairman of the board of the Standard Oil Company of New Jersey.

Gubb was graduated from Cornell in 1916, and elected president of the Cornell Alumni Association in 1942. A member of the class of 1919, Victor Emanuel is a partner in Emanuel and Company, a New York City banking firm, in addition to serving as head of Aviation Corporation. He has served on the finance committee and Veterinary College Council of the Cornell board of trustees. Walter Teagle, who received the Cornell B.S. degree in 1899; has served on the finance committee, and on the public relations sub-committee of the planning and development committee.

G. P. Donnellan, C.E. '10

MAJOR George P. Donnellan, C.E. '10, is assistant post engineer at Camp McCann, Miss.

R. Stephens, M.E. '32

RODERICK Stephens, '32, civilian project engineer in charge of development of the amphibian truck, recently visited Camp Gordon Johnston, Flariday, to collate information for the new "duck" manual. He returned in October from the European and Pacific Theaters where he observed the vehicle under combat and service conditions. Stephens is the designer of the "duck" and inventor of several of its auxiliary attachments.

S. W. Mudge, M.E. '13

STERLING W. Mudge, M.E. '13, has returned to his former position as director of education and training for Socony Vacuum Oil Co., Inc., New York City. He has been on leave for two and a half years with the War Manpower Commission as director of the training-within-industry service for New York State. His address is 12 The Place, Glen Cove.

New Jersey Meeting

THIRTY-ONE members of the New Jersey Regional Group of the Cornell Society of Engineers were present at the meeting which was held at 12:30, December 1, 1944 at the Newark Athletic Club.

Mr. Carlton Reynell, Chairman, presided.

In order to provide more time for

Mr. Gubb

the speaker, and discussion, minutes of the previous meeting were not read.

The speaker, Professor C. D. de Wiewiet gave one of the most interesting talks they had ever heard, outlining in general the possible influence of the United States, Great Britain, and Russia on other nations in Europe now and during the peace to come. He also gave an insight into possible relations between the United States and Russia. In addition he explained the military and civilian Russian courses that have been given at Cornell. A discussion followed.

G. G. Mitchell, C.E. '28

GEORGE G. Mitchell, C.E. '28, of 1901 Riverview Avenue, Wilmington 47, Delaware, has returned to E. I. Du Pont de Nemours & Co., where he is in the industrial relations division, after two and a half years with Remington Arms Co., Inc.

R. F. Greenawalt, M.E. '34

CAPTAIN Russell F. Greenawalt, M.E. '34, AUS, and Elizabeth Page, daughter of Wilson K. Page '09, were married September 18 in Olean. Captain Greenawalt is Ordnance Advisor at the Sangamon Ordnance Plant, Springfield, Illinois. Mrs. Greenawalt was formerly secretary to Dean S. C. Hollister, of the Engineering School.

W. S. Schneider, M.E. '27

W. Sherwood Schneider, M.E. '27, of 16 Undercliff Road, Milburn, N. J., is plant engineer, Newark, N. J., plant, E. I. Du Pont de Nemours & Co.

A. F. Williams, C.E. '15

LIEUTENANT Commander Alan F. Williams, CEC, USNR, is commanding a Naval Construction Battalion in the Pacific theater.

D. G. Roos, M.E. '11

DELMAR G. Roos, M.E., '11, vice-president of Willys-Overland Motors, presented a discussion of Army experiences and future applications of the "jeep" at the Society of Automotive Engineers' metropolitan section meeting, Oct. 12. Through years of engineering contributions now climaxed by his direction of Willy-Overland engineering development of war equipment, Roos has been responsible for the major part of the development of this war machine.

NEWS OF THE COLLEGE

Delta Club Elects

New members who were initiated on December 9 by the Delta Club are:

John Hastings
Dave Nimick
Ted Bauer
Paul Moore
Warren Newman
Dick Patrick

A second initiation will be held near Christmas. Faculty members of the Delta Club are:

Meserve, W. E., Ass't Prof., Electrical Engineering
Gross, E. T. B., Ass't Prof., Electrical Engineering
Northrop, B. K., Ass't Prof., Electrical Engineering
Malti, M. G., Ass't Prof., Electrical Engineering
Burkmeyer, L. A., Jr., Ass't Prof., Electrical Engineering

Naval Graduation

Capt. W. R. Cooke, USN, Commander of Amphibious Training Center, Solomons, Md. urged 185 graduating midshipmen of U. S. Naval Training School, Cornell University, in Bailey Hall Thursday, November 30, to go out and add their contribution to the list of ports invaded. The streets in Solomons, Md., where Captain Cooke is stationed, "are named after ports we have successfully invaded," he continued. "There is every indication that you graduates will give us new sign-posts to erect, and be proud of. Until Tokyo Road is established and trampled on, we cannot let our enemies have a second's rest."

Speaking with natural pride and understanding from his own experience with amphibious training, Capt. Cooke traced the beginning and growth of amphibious forces in this war from "not one single amphibious craft to over eighty thousand ships and boats from landing ship tank to landing craft rubber." He explained the magnitude of the job assigned to landing craft which has included the building, training and operation of thousands of landing ships, transportation of millions of troops and "the greatest problem of transporting supplies the world has ever known." He attributed the low record of casualties on landing craft (in proportion to numbers involved) to preparation, training, and teamwork.

Capt. Cooke advised the new ensigns to keep abreast of scientific development which has proved so important on both sides. He warned them against snobbishness in dealing with their men, saying, "There should be no room in the heart of an officer for the conceit that shows itself in arrogance . . . Go to your men . . . giving the best and expecting the best."

In regard to over-confidence, he stated, "We cannot afford for a moment to relax . . . until the last Jap is killed or cured of his ideas, we have a job to finish."

Keep Off Trails

People entering gorge trails around Cornell University this winter will do so at their own risk, Mr. H. B. MacNamee, Grounds Superintendent stated today. Because of the labor shortage the university can not guarantee to keep the trails open. The sections near the gorges are especially treacherous at this time.

Cornell Telephones

Use of telephone service at Cornell University has increased greatly since the war, particularly with 637 phones assigned to the Army and Navy out of the 2,250 on the university exchange. The calling rate per day averages approximately 10,000, and at peak hours between 10:00 a. m. and noon the load occasionally gets beyond the capacity of Cornell's PBX (private branch exchange).

As a result of the load, F. O. Spaid, manager of the Ithaca office of the New York Telephone Company, states that telephone officials are considering ways to curtail the number of non-essential calls, particularly those of extended length, such as night calls to women's dormitories which often last for a half hour or longer.

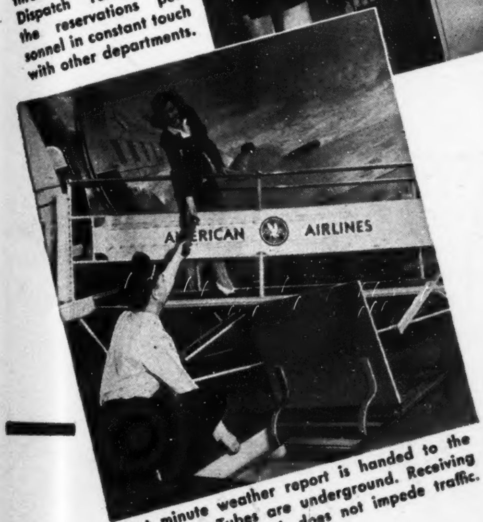
The number of civilian telephone calls throughout the U. S. has increased more than 40% since the start of the war, and records of the Cornell exchange are no exception to that figure. Coupled with service demands from offices of the Army and Navy, the 13 operators who handle the 24-hour service at Cornell's PBX are each endeavoring to complete nearly 800 calls during an eight-hour shift.

Long-distance calls from the university average 100 a day, going to every state in the Union, to Canada, Central America and countries in South America. The number of calls to Porto Rico is above average because of a fairly heavy enrollment at Cornell from that country. Telephone facilities over the Atlantic and Pacific oceans are taken up for war purposes and are not available for civilian use.

Equipment at the PBX is very modern, the new board having been placed in Olin Hall during early 1942. All lines between buildings are underground. Distribution of wires in dormitories is made possible by enclosing them in ducts or other types of distributing facilities, installed when the building was erected. When a new building is planned, consideration is given to the conduits for telephone cables to avoid poles and overhead wires. In the case of older buildings, such as Sage and Risley, steel molding has been installed through corridors to conceal the wiring.

Night operators are able to signal to campus police in emergencies by means of lights placed high on campus buildings. When a policeman is needed, lights are switched on, the officer calls from the nearest telephone and receives the message from an operator. Prowlers and other malefactors are quickly discouraged.

Three incoming and three outgoing Lamson Dispatch Tubes keep the reservations personnel in constant touch with other departments.



Last minute weather report is handed to the stewardess. Tubes are underground. Receiving station, when closed, does not impede traffic.

Human messengers are much too slow for the streamlined efficiency of American Airlines. At the Washington airport, Lamson Dispatch Tubes interconnect the reservation and ticket offices, on the second floor of the Terminal Building, with the load room downstairs, and the loading ramp a quarter of a mile away. Weather reports, manifests, memoranda, unerringly speed to the proper destination. Confusion and delay have been entirely eliminated in the handling of paper work.

Ten times faster than human messengers Lamson Dispatch Tubes never make a mistake, never take time out for lunch. Write for our booklet, "Wings of Business" which shows the speed and efficiency which Tubes can bring to the handling of paper work, small objects and small tools.

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Because of the paper shortage we can send this booklet only to those who name their college and class.

An Essay . . . .

PHYSICS APPLIED

By ANTHONY R. MORROW, Arch '46

UNFORTUNATELY Noah Webster defined the word *physics* as the science of motion and matter dealing with inanimate objects. This was a mistake. The fundamentals of physics apply to our fellow humans as well as they ever did to any tennis ball or cosmic ray.

As practically nothing has been written on this inexhaustable subject, we shall confine ourselves to the landlady and her college boarder. Both are victims of external forces which mankind has chosen to call circumstances. Any student of physics can tell you that everybody continues in his state of rest in so far as he is not acted upon by external forces. (*Everybody* is usually written in textbooks as *every body*, but it is more adaptable to our purpose when written as above.) This natural state of rest under normal conditions is said to be a state of equilibrium. We may therefore say with safety that the landlady and her college boarder are said to be in a state of equilibrium when the rent has been paid.

Taking an external force, let us say the back rent for four weeks, we find that both parties are set in a state of motion. The second law of motion may be applied under this circumstance. The boarder acted upon by this external force proportional to the distance from the front door to the street and inversely proportional to the mass of his own body.

There is, however, that other law of motion that states that any action of one body upon another body is accompanied by an equal and opposite reaction of the second on the first. In this situation the boarder explains desperately why the rent has not been paid. If his plea lacks a sufficient amount of force we may say that any law dealing with the acceleration of falling bodies will apply to him.

Then too, unhappily for the boarder, the landlady has what is known as potential energy. Potential energy is that kind of energy that a body has by virtue of its position. The landlady has virtue of position by a slip of paper that is termed the lease. It is the lease which contains all laws dealing with electricity, heat, and light. Here we have a number of rules:

1.) The electrical overload is the exorbitant amount charged by a landlady for a radio in the room.

2.) Heat may be overlooked as in this situation it is almost negligible.

3.) Light is a constant factor and is sometimes referred to as *the* twenty watt bulb.

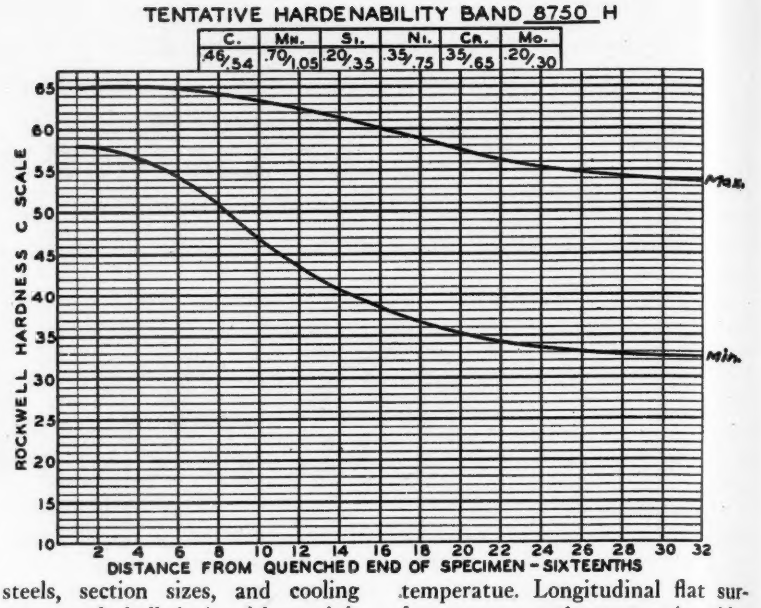
Above and beyond the natural laws we have what are known as the phenomena of physics. They are for the most part unexplainable, but the landlady, nevertheless has theories about them. These phenomena usually consist of broken furniture and beer bottles on the window sill. The only things that are definitely known about them are their angle of incidence and angle of reflection. The former is the way in which the boarder explains his version of how the incident happened while the latter is the reaction taken by the landlady after she has heard the story.

THE ROAD TO LEARNING IS NOT SMOOTH

Hardenability

(Continued from page 15)

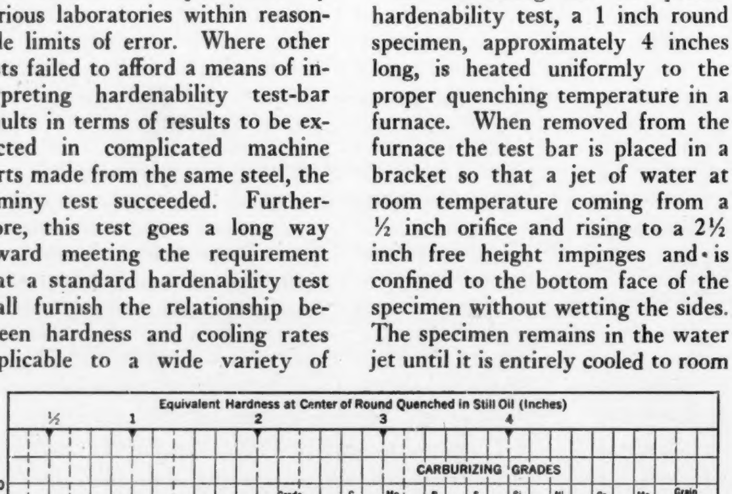
known, the Jominy test. This test came as a result of an active investigation of measurements of hardenability by a group known as the "Steel Standardization Group" under the leadership of F. E. McCleary of Chrysler Corporation. The group consisted of representatives of the Bethlehem Steel Co., Great Lakes Steel Corp., Carnegie Illinois Corp., Chrysler Corp., Pittsburgh Crucible Steel Co., Republic Steel Corp., and Timken Steel and Tube Co. Representatives of this group made tests in their various laboratories to try out several hardenability methods and to attempt to check one another, thus determining how closely these tests could be made. The records of investigation fill several volumes. Finally it became apparent that the Jominy end-quench test was the most suitable.



Useful As A Standard

The end-quench test is particularly adopted to standardization since results are reproducible by various laboratories within reasonable limits of error. Where other tests failed to afford a means of interpreting hardenability test-bar results in terms of results to be expected in complicated machine parts made from the same steel, the Jominy test succeeded. Furthermore, this test goes a long way toward meeting the requirement that a standard hardenability test shall furnish the relationship between hardness and cooling rates applicable to a wide variety of steels, section sizes, and cooling rates; and shall do it with a minimum amount of work. The Jominy test makes it possible to measure accurately a wide range of cooling rates, thus providing the fundamental relationships between cooling rates and hardness.

In conducting the end-quench hardenability test, a 1 inch round specimen, approximately 4 inches long, is heated uniformly to the proper quenching temperature in a furnace. When removed from the furnace the test bar is placed in a bracket so that a jet of water at room temperature coming from a ½ inch orifice and rising to a 2½ inch free height impinges and is confined to the bottom face of the specimen without wetting the sides. The specimen remains in the water jet until it is entirely cooled to room temperatue. Longitudinal flat surfaces are ground on opposite sides of the specimen to avoid the effects of surface decarburization, and Rockwell C scale readings are taken at 1/16 inch intervals. The flats of the test bars must be ground very carefully to avoid the generation of too much heat and a consequent tempering and reduction of hardness. Hardness readings should be taken along two sides and the results averaged. The data secured is plotted on cross-section paper, using Rockwell C scale values as ordinates and distances from the quenched end as abcissae. When end-quench curves approximately coincide the steels usually have equivalent properties in equal sections and with similar treatments.



Uses of Jominy Test

The Jominy test, as described, finds a great number of uses. It is possible by the substitution of cooling rates in place of corresponding hardnesses to determine easily the cooling rate at any place, in any shaped article, be it round, square, slab, cone, or complicated machine part. This immediately gives us a prominent use of the Jominy test; i.e., determining what hardness to expect in an object by referring to the hardness-cooling rate curve (known as the H-CR curve) for that steel. The H-CR curve is the curve obtained by substituting cooling rate values in place of values for distance from the quenched end of the test bar.

(Continued on page 36)

Constant Hair-splitting

to give you Constant Performance

The great part that close tolerances play is one of the reasons why Busch-Sulzer Diesels are noted for their ability to give year after year of reliable and economical service.

For example, every eight hours, when a new shift reports, all gages are given a microscopic examination capable of disclosing errors in millionths of an inch. Only when a cross-hair exactly splits two other cross-hairs is the gage under examination up to Bureau of Standards specifications and ready for work.

This hair-splitting precision plus the skill of America's oldest builder of Diesels has resulted in engines famous for their simplicity of design, which makes for fewer moving parts, better lubrication, less wear and long life.

* * *

At the moment that the progress of the war permits, our greatly expanded facilities will be at your disposal without reconversion delays. Acquainting us now of your requirements will be a time-saver. We build both 2-cycle and 4-cycle stationary and marine Diesels with a variety of speeds. An inquiry on your letterhead will get our prompt attention.

By actually splitting two tiny cross-hairs with a third cross-hair, this microscopic inspecting instrument puts the O. K. for accuracy on the many gages used in Busch-Sulzer's close tolerance work.

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Hardenability

(Continued from page 34)

The first step in predicting hardness is to determine the cooling speed at various points in the object under consideration, which is accomplished by making the object out of a low-hardenability steel, quenching the part in oil or water (depending on whichever is to be used in production), determining the hardness at various points in the cross section, and finding the cooling rates by reference to a H-CR curve. The next step is to decide what hardness is required in the object. Then H-CR curves for a number of different steels are examined and the steel is selected which meets the foregoing requirements. It is necessary that the heat treatment and the steel used for the object to be studied for cooling rates be the same as for the Jominy test bar used to obtain the H-CR curve.

National Emergency Steels

When the present war caused the steel industry to have a critical shortage of alloying materials, the industry had to find alloy steels which would replace those steels no longer available for the civilian consumer. The result was the National Emergency (NE) steels. In many cases these steels were introduced with only end-quench hardenability curves available for comparative properties. In other words, compositions minus critical materials were varied until an end-quench hardenability curve was secured which approximated that of the steel to be produced.

Grossmann has developed a method of determining hardenability from chemical composition. By applying certain factors to the different elements present in an alloy steel he was able to obtain "ideal hardenability" curves. Grossmann's ideal hardenability will determine, in advance of physical testing, the anticipated reaction to heat treatment. Calculated hardenability will probably give a better idea of a given type of steel than tests on a single heat. It is a good preliminary but not a substitute for actual hardenability tests. Grossmann's development is closely allied with the production of NE steels.

Due to the fundamental dependence of hardness exclusively upon cooling rates, it should logically be the basis of classifying steels both for specification and selection purposes. As a result of cooperative work done by the Iron and Steel Committee of the War Engineering Board and the Iron and Steel Division, General Standards Committee, of the Society of Automotive Engineers, Inc., and the Technical Committee on Alloy Steel of American Iron and Steel Institute, hardenability bands have been devised which are considered satisfactory for use in describing certain characteristics of constructional alloy steels. This use of hardenability bands, although tentative, satisfies to some measure the desire to incorporate into specifications certain hardenability limits as a means of better control of steel and steel products. Steels for which hardenability bands have been determined are designated as "H" steels. Through use of hardenability bands, a steel may be specified by indicating on the maximum and minimum hardenability curves either of the following:

A. The minimum and maximum distances at which any desired hardness value occurs.
B. The minimum and maximum hardness values at any desired distances.
C. Two maximum hardness values at two desired distances.
D. Two minimum hardness values at two desired distances.
E. Any part on the minimum hardenability curve plus any point on the maximum curve.

The specification of "H" steels will provide the user, it is predicted, with material of greater uniformity with respect to those characteristics which the end-quench hardenability test determines. The more important of these characteristics are (1) maximum quenched hardness, and (2) the depth to which hardening is necessary to assure the final desired mechanical properties.

The clear trend seems to be toward a relaxation of chemical limits; the steel of the future will probably be specified as a certain type; exact chemistry will be of minor importance to the purchaser as long as the steel falls within definite limits of hardenability.

Standardization

(Continued from page 18)

the Western Hemisphere will have standards as much alike as possible." The achievement of this goal will be an invaluable aid in strengthening trade relations.

Cyrus T. Brady Jr., an engineer and sales executive who has spent many years in South America, was given a leave of absence from the United States Steel Export Company to serve as the first Latin American field representative for the ASA in its new project. He was supported by the staff of the Inter-American Department in New York, under the directorship of Alberto Magno-Rodrigues, former director of activities of several American corporations in Spanish and Portuguese markets. In this arrangement the field representative represents the ASA in the Latin American standards groups, while the New York office provides the groups with translations of standards that would be valuable in their industries and also keeps them informed of current standardization work here.

More Men

As established, this department was merely a skeleton organization. One field representative cannot cover all of Latin America by himself. As the program develops more and more technical men are being added to the field to give the ASA ample contact with every important standards group in Latin America.

Mr. Brady was in Latin America the better part of 1943 investigating one country after another. This first trip was, more or less, a survey to determine the exact nature of the standardization setup in each country so that the best course of action could be planned accordingly.

Late in 1943 the survey was completed, and Brady summarized it in the form of a report entitled "The Standardization Movement in Latin America." Printed later in pamphlet form, this report gave a detailed and useful picture of the status of industrial standardization in Latin America, what the United States has had to do with it, what is

(Continued on page 38)

Standardization

(Continued from page 36)

being done, and what could be done. Much of the material in this article, both following and preceding, is taken from it.

Superficial Unity

One of the most important considerations in dealing with Latin America is that only the most superficial sort of unity exists between the twenty republics. The physiography, customs, and government ideology vary greatly. These factors have had important effects upon industry, so that industrial development is in many stages of development throughout Latin America.

For example, Uruguay, with roughly the same area and population as Ecuador, has ten times the per capita steel consumption, sixteen times as many automobiles, and three times the railroad mileage. The annual per capita steel consumption, a fairly reliable gage of a country's industrial development, ranges from 100 pounds in Argentina to 3 pounds in Haiti. In the United States the normal consumption is about 700 pounds.

Since standardization is a result of, and a stimulus to, industrialization, one can judge from the industrialization of a country its readiness for, and need of, standardization.

Chile—nitrates

Standardization is actively under way in but four Latin American countries, Argentina, Brazil, Uraguay, and Mexico. Peru and Chile have begun to display great interest in the movement, but little interest has been shown by the other countries. The Union of South American Associations of Engineers has created a "South American Committee for Technical Standards." This group is still in its infancy, but it promises to become the most important standards group in all of Latin America.

Argentina

In Argentina, the most industrialized Latin American country, a highly centralized national government controls most of the transportation and communications systems. The first standards were developed by the individual government departments, but since these often conflicted, a national standardizing group was sought. In 1937 the Instito Argentino de Racionalizacion de Materiales (IRAM) was formed. It is a private organization similar to the ASA with a membership including municipal, provincial, and national government divisions, universities, trade schools, professional associations, and corporations. Twenty-nine American firms are members, but German and British membership is even more extensive.

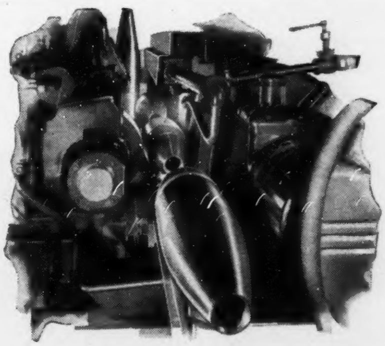
The Board of Directors and subcommittees of IRAM are required to maintain a balance between technical men, manufacturers, and consumers. Any of their standards which are approved by the national government become obligatory in all government departments, but not in private industry. Govern-

(Continued on page 40)

Peru—copper

The shell that brings 'em back alive-

What makes a Nazi surrender? Sometimes it's a "prisoner passport" delivered in a propaganda shell, compliments of the U. S. Artillery. Today industry is turning out all types of shells faster than anybody ever dreamed. Certainly Carborundum takes great satisfaction from the big part its products play in this vital war job! Nowadays shells big and little pour out of centerless grinding machines like this in a never ending stream.



Abrasives by Carborundum also keep tools sharp, and finish metal, wood and plastics. Super Refractories by Carborundum line high temperature furnaces and help solve the problems of the process and chemical industries. "Globar" electric heating elements increase the efficiency of high temperature heat treating furnaces, ceramic kilns, etc. This wide industrial coverage offers exceptional opportunities for Engineer-salesmen. If interested, please write The Carborundum Company, Niagara Falls, New York.

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Standardization

(Continued from page 38)

ment intervention in industry is so widespread, however, that such standards are sure to be quite widely observed. More than 250 standards are now in some stage of development.

Uruguay is, in industrial development, quite similar to Argentina. In 1941 the Instituto Uruguayo de Normas Tecnicas (UNIT) was incorporated. This group is almost identical in organization to IRAM.

In Brazil, where steel production is already very considerable, important standardizing groups have been in existence since 1930. In 1940 the Associacao Brasileire de Normas Tecnicas (ABNT) was organized to coordinate the work of all these groups. This body, also, is similar to the ASA, its membership including corporations, official and semi-official institutions, and interested individuals. One of its main tasks now is to prepare emergency standards to meet the war situation.

About two years ago, the Mexican Government established a "Department of National Standards." The bureau which preceded it had been a paying member of ASA, and was thoroughly familiar with the standard'zation movement throughout the world. An elaborate program was quickly drawn up covering a very wide field. At present the emphasis is on standardization of goods purchased for the Mexican Army. Although the Department is strictly by and for the government, its standards may come into wider use.

In Peru and Chile industry has developed to the point where a need for standardization is clearly felt. The establishment of national standardizing bodies was being seriously considered in both countries.

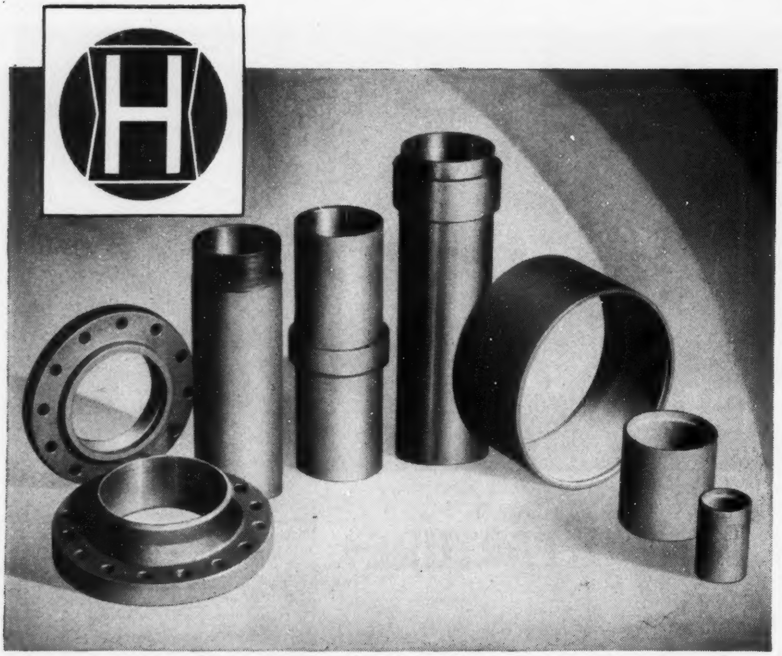
In the other fourteen Latin American republics industry is so undeveloped that there has been no need for, nor movement toward, standardization. At present these countries are of little importance in the program of inter-American industrial standardization, but Cuba and Columbia seem to be developing quite rapidly.

Throughout all of Latin America, but particularly in Argentina and Brazil, the British and Germans have in the past displayed greater interest than we in standardization. The times when British and American interests coincide, however, greatly outnumber those when they are opposed. The recently established British-American standardizing project, and the still more recent Inter-Allied Standards Council will make these disagreements even more infrequent in the future.

German Interests

The German interests are still a powerful force to be reckoned with. Although the official German organizations can no longer be represented in most of the Latin American standards bodies, the now stranded German-owned firms have more time than ever to devote to the standardizing movement.

If the United States continues along its newly set path to full and friendly cooperation with the industralized countries of Latin America, inter-American industrial standardization can be achieved. Such an achievement will go a long way in increasing world trade and maintaining world peace.

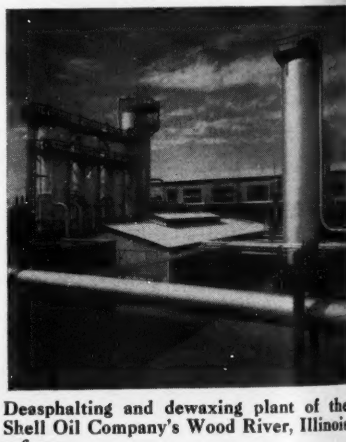


Chemical Engineering

(Continued from page 8)

least partly processed in the country of origin. We have seen the first signs of this in the recent loan to Mexico, and in the address of the Chinese representative at the monetary conference. If the United States is politically wise, she will see to it that at least a proper part of this industrialization is effected with the co-operation of American interests and by American engineers. This should open up a rather new and very important field of "foreign service" for men with engineering training.

Finally, there is a whole group of what might be called "insurance industries" that should be fostered as safe guards against the future emergencies of war or of foreseeable shortages of fundamental materials. The synthetic rubber industry is one of these; we should not again have to rely on a remote foreign source of a material so basic both in war and in our peace-time economy. Another such insurance industry is the production of sugar (glucose) from waste wood. Most of our industrial alcohol is usually



Deasphalting and dewaxing plant of the Shell Oil Company's Wood River, Illinois refinery.

made from cane-sugar molasses; in normal times this will continue to be the cheapest and best raw material, but we should not be so largely dependent on a foreign material for so important a chemical product. We should be actively developing the production of oil from coal; the United States will almost certainly become increasingly dependent on foreign sources of petroleum, and we must have at least the technical information needed to replace this imported oil from domestic sources.

Carbon Dioxide

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In ships with oil-fired boilers, leaking oil lines drain into the bilge, so that total flooding is often used to protect this space. Total flooding is also employed to extinguish fires in the engine rooms of ships propelled by internal combustion engines.

Airplanes, Motor Vehicles and Motorboats—Total flooding is likewise used to extinguish fires in the engine compartments of airplanes, military tanks and motorboats. In these installations, the operator is commonly warned of fire by a red signal lamp on his instrument board, which is lighted by some form of heat-actuated release. He then pulls a handle and discharges carbon dioxide into the space to extinguish the fire.

Carbon dioxide also protects the cargo compartments of transport planes and provides an inert atmosphere in and around the fuel tanks of fighting planes to prevent tracer bullets from igniting the gasoline. A recent development of this company is an aircraft smoke detector for detecting fire in cargo spaces. The detector, which is a variation of the marine smoke detection system, has a very small, light-weight cabinet into which air from the cargo space is constantly forced by a blower or by an exhauster that makes use of the air currents caused by the flight of the plane. Smoke particles in the air stream automatically actuate the mechanism that sounds an alarm and lights a red lamp on the pilot's instrument panel.

Smoke detecting cabinet in a ship's wheelhouse.

"Crash trucks," carrying large quantities of carbon dioxide, are used at all important airports to extinguish fires in crashed planes.

Portable carbon dioxide extinguishers are approved by the Interstate Commerce Commission for trucks and other motor vehicles.

Maintenance

To keep carbon dioxide fire-extinguishing equipment in readiness for use when needed, it is inspected periodically and the cylinders weight-checked once a year. Simplified bracketing arrangement of system cylinders and connection of discharge heads to cylinder valves provide for easy removal of any cylinder without disturbing the rest of the system.

As carbon dioxide does not deteriorate in storage, recharging is required only to replace gas lost through discharge or leakage. Large users often have their own recharging equipment. Others have cylinders recharged by service agents or carbon dioxide plants, which are located in all principal cities.

John Fraser

(*Continued from page* 16)

ert can look mighty forbidding and lonely at night. But there wasn't a thing to do, so we just bedded down for the night. The next day we walked ten miles, under a boiling sun, to the nearest mine. They eventually sent a truck out to tow us, and after about two miles, the darn car started.

"The foreman of the mine diagnosed the trouble as 'vapor-lock', and he cussed the gasoline in those parts of the country with a fluency that was something amazing.

"Well, sir, right then and there I decided that something was going to have to be done about that gas situation—and figgered that maybe I was the one to do it. So I decided to become a chemical engineer."

Now in his senior year, J. P. must certainly consider his decision a wise one for his record here is enviable. One of Coach Sanford's boys, he rowed on the J.V. crew last spring, was one of the varsity men through the summer, and is vice-president of the Crew Club. Top man in his class—there are ten of the original one hundred sixty who started—he was elected to Tau Beta Pi in his junior year, and now heads the Cornell chapter of that honorary society.

Making good use of an art learned on the western plains, J.P. was a regular on the Rifle Team last year. He pledged Triangle fraternity in his freshman year, and he is now one of the few remaining members at Cornell.

John has no definite plans for his future in the Navy, figuring (and rightly so) that they'll put him where they darn well please. After the Navy, he plans to return to Cornell for his B.Ch.E. as he will graduate with a B.S.Ch.E. in June. Beyond that, his plans for the future are rather vague. "I've still got my eye on petroleum," he explains. "Something's got to be done about that vapor-lock, but I may wind up in either the heavy chemical industries or pilot-plant work. At present, I'm working on a benzene-alcohol mixture for my roommate's car, and if that's successful, who knows, I may go into production on my own."

Although we sort of doubt the possibility of that last, we know, from long experience, that anything J.P. starts is liable to wind up a big success—so we won't be too surprised if about ten years hence, we'll be buying some Gawd-awful mixture from "J. P. Fraser, Inc." —you know Fraser, the big industrial tycoon—to run our post-war airplane.

"Al" Allen

(*Continued from page 17*)

thing," Allen said, "and something comes along and takes me out of it. I started off at VMI, and I thought I'd spend the rest of my college life there and keep those friends for the rest of my life. Now I hardly know where any of them are. First at college, then at a job, then in the Navy, now in the V-12. I can't realize that this is the start of my life and I feel as thought I'm going to start off on another tangent soon." Don't worry, Al, you'll come back to Cornell; and we hope we're here to welcome you.

Tau Beta Pi Essays

(Continued from page 20)

a dog when its tail is wagging, but he carries an inherent distrust of smiling men. In this way many attempts at friendships are thwarted even before they are able to develop.

This inherent distrust is not the only negative weight a man carries in his mind. For instance, how many of us would drink from the same stream in which a herd of cows had been drinking? We have been reared to believe in germs and their deadly effects and do not bother to reason that the cows, susceptible to the same germs, had probably drunk there all their life without ill effects. At any rate, we go thirsty.

How many of us would dare to walk a twelve-inch catwalk and one hundred feet above the ground without handrails? The fear of what might happen keeps us from performing this otherwise simple feat; so we stay on the ground.

All of this merely indicates that men are slaves to their own thinking and that they suffer thereby.

On the other hand, freedom is one of the essentials of beauty. Who can match the beauty of a gull high above the water, with motionless wings, lazily gliding downwind, then neatly coming about, and soaring to an even greater height? Nothing to do all afternoon but to soar and glide. Or does anyone know of more beautiful music than the random patter of raindrops on a tin roof, or the hushed whispering of the woods in June, or the not-quite-rhythmic beat of ocean waves upon the shore?

Is it not a wonderful feeling to lie down, stretch the kinks out of your tired muscles, close your eyes, and erase the worries of the day from your mind? Or to linger under a hot shower, just to soak up the heat? Or to relax in a barber's chair and leave the control of your head to his hands, knowing that he will not harm it?

Were it not for the occasional enjoyment of such beauties, what would be the point of living. I see reason to believe that freedom is an essential to life. It is difficult to keep a wild animal alive in captivity, not because one cannot duplicate his natural diet and climate, but because the animal has lost the will to live.

And it is the same with men. Men who carry self-imposed inhibitions live a confused, aimless life. You never find a wild animal committing suicide, or worrying itself into such a state that its mind cracks.

It has been said that man's greatest enemy is man. A direct corollary is that a man's meanest and most heartless master is himself.

Power of Music

By George G. Swanson, ME '44

SOME years ago, John Ruskin made the assertion that the most beautiful things in the world are the most useless. This statement is in utter disregard of the tremendous potential powers of music.

The modern psychologist is well aware of the possibilities of musical therapy in these times when there is a great need for release from ten-

(Continued on page 50)

Tau Beta Pi Essays

(Continued from page 48)

sion and fear. Our hospitals are beginning to fill with those unfortunate enough to suffer mental and emotional breakdowns under the stress of war. The results of the application of musical therapy alone, or in connection with other types of therapy, has met with astonishing success.

The question now arises, of how, or by what process does music so affect us that it can be used to heal the mind and the body. The answer is not simple since so relatively little is known about the mind and body at the present time. It is, however, agreed that music affects us through three levels; the physical, the emotional and the spiritual.

The physical reaction is one in which there is a response to sound by our central nervous system with a consequent change in muscular action. Also affected, is the autonomic nervous system which controls our internal bodily secretions which in turn have a direct bearing on our emotional balance. The two aforementioned reactions are very closely related. The more primitive type of person responds very markedly to music which influences the physical and emotional senses. The throbbing pulse of boogie woogie, the glamorous beat of military music, or the soothing strains of a lullabye are examples of music which tend to make the body and emotions respond automatically and quickly.

The third level, or spiritual reaction, is more difficult to define. It is largely a matter of suggestion and is also one of the more potent keys to be used to unlock the tortured mind and allow the alternation of stimulating and soothing influences of rhythm to enrich and actualize our associations. A Beethoven Minuet or even a simple folk song may strike some familiar chord and soon our present fears are forgotten as we escape into the realm of harmony. We now have something which gives form to our innermost dreams and longings. The listener tends to forget the music entirely in the visionary associations it stirs. The degree to which the listener reacts to this manner of stimulus is largely a function of his past experiences and intelligence.

When properly selected, music is directed into the three afore-said channels, and one can begin to tap the power which is held in the beauty of music. Countless examples can be cited of how men and women have been brought to an even keel through the gentle suggestion of music. Men who have sat continually staring into space are suddenly led back to reality by a familiar waltz or symphony. Paralysis, amenesia, and hysteria have, in many instances, been cured by music alone. Doctors are now using music before operations to dispel apprehension and relax the patient. Insomnia is also treated successfully with this method. In spite of the high number of successes, little is known about what music to play to what individuals. Since different people react differently, musical therapy is still largely a hit or miss proposition. When properly understood, use of music as a means to cope with the complexities of our modern pace of life may become a necessity which may secure our physical, emotional and spiritual well being.

STRESS and STRAIN...

Once in never never land there was a grave digger who was either very eager or very weak mentally, for at quitting time he found himself in a grave so deep that he was unable to climb out. Late that night he heard some prowling about so he shouted up.

Help me, help me, I'm very cold down here."

The prowler, who turned out to be a drunk, looked over the brink and then said "No wonder, no wonder; you don't have any dirt on top of you."

* * *

Mrs. Glump dashed into Mrs. Bonzo's house screaming, "Your little Hugo is spoiled."

"Here now, he is not, he is a very unspoiled boy," was Mrs. B.'s reply.

"But that was before the steam roller ran over him," said Mrs. Glump.

* * *

"I guess I've lost another pupil," said the professor as his glass eye rolled down the sink.

* * *

Latest GLF report:

Poultry is up two cents a pound, but live pigeons continue to drop a a little.

* * *

"Long Jawn" Fraser, after due consideration, states that the most popular shades this winter will be those left up in the co-ed's windows.

* * *

"Oh yes," sighed the Co-ed, "I know Mr. Browning. He's the cutest Chief Petting Officer on the hill."

* * *

All of which reminds us of our friend Malcolm Hecht who, until he joined the Navy and had to wear one of the damned things, thought that a neckerchief was a sorority president.

* * *

Concerning the girl situation at Cornell, we have only this to offer. *Never have so many pursued so few, with so much, and got so little.*

A Policeman came home late and, undressing in the dark, slipped into bed. His wife woke up and said, "Clancy, would ye mind runnin' out and gettin' me a headache powder? Me head's splittin'." Clancy fumbled into his clothing and complied. The druggies served him and said as he handed him the powders, "By the way, aren't you Officer Clancy?" Clancy said, "Yes." "Well then," asked the dispenser, "What are you doing in that fireman's uniform?"

—*Powerfax*

A young woman who had recently taken charge of a kindergarten entered a trolley car; and as she took a seat, smiled pleasantly at a gentleman sitting opposite her. He raised his hat, but it was evident that he did not know her.

Realizing her error, she said in tones audible throughout the car: "Oh, please excuse me! I mistook you for the father of two of my children."

* * *

A shoulder-strap is what keeps an attraction from becoming a sensation.

Well, the reason they call her "Discontinuous Integral" is because she has no limit.

* * *

"Where's the Chief?"

"He's over in the dorm hanging himself."

"Did you cut him down?"

"No, he wasn't dead yet."

* * *

Heard in a Structures class during a discussion of types of trusses

Student from points north: "But won't the panels on that Baltimore truss collapse?"

Student from Baltimore: "Suh, a Baltimore truss is never caught with its panels down."

* * *

Advice to eager C.E.'s—Get your mind in the gutter when you take Sewage 252.

* * *

A patient of an asylum who had been certified as cured was saying goodbye to the director of the institution. "And what are you going to do when you go out into the world?" asked the director.

"Well," said the Ex-Nut, now looking rather distinguished in his tailored business suit, "I have passed my bar examinations, so I may try to work up a law practice. Again, I had quite a bit of experience with dramatics in college, so I might try my hand at acting."

He paused and thought for a moment.

"Then, on the other hand, he continued, "I may be a tea kettle."

* * *

Mrs. Zeke dashed to her husband's place of work which happened to be a coal yard. There she saw Zeke standing. She ran up to him and said, "Zeke are you all right? I was told that five tons of coal had fallen on you."

"Sure I'm O.K. It was just some soft coal."

* * *

"Hell, yes," said the devil picking up the phone.

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